How to Run a Railroad

EVERYTHING YOU NEED TO KNOW ABOUT MODEL TRAINS

BY HARVEY WEISS

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Illustrated with photographs and drawings by the author

If you are just getting started in model railroading—if you are about to buy a set of trains or already own the trains but don't know what to do with them—this is the book for you. In a lively and comprehensive text and with scores of handsome photographs and drawings, Harvey Weiss describes everything you must know to set up the trains and get them running and to build a layout for them that will exactly suit your tastes.

Opening with chapters on the different kinds of trains—O gauge, HO gauge, and N gauge—and where to buy them, Mr. Weiss explains in detail how to make a train table and attach the tracks to it, the various ways of laying out the tracks, the basic electrical facts needed to start the trains and to handle breakdowns, and how to make inexpensively trees, ponds, grass, stationhouses, bridges, water tanks, and derricks—all the parts for an inspired and realistic model railroad world.

Describing step-by-step his own experiences with the model railroad he built—telling of the mistakes as well as the successes and of some of the more ambitious and zany possibilities he explored—Harvey Weiss has written an imaginative and truly useful introduction to one of the most popular and enduring hobbies of all time.

How to Run a Railroad

Also by Harvey Weiss:

The Gadget Book
Games and Puzzles You Can Make Yourself
How to Make Your Own Books
Model Airplanes and How to Build Them
Model Cars and Trucks and How to Build Them
Motors and Engines and How They Work
Ship Models and How to Build Them
How to Run a Railroad

HARVEY WEISS

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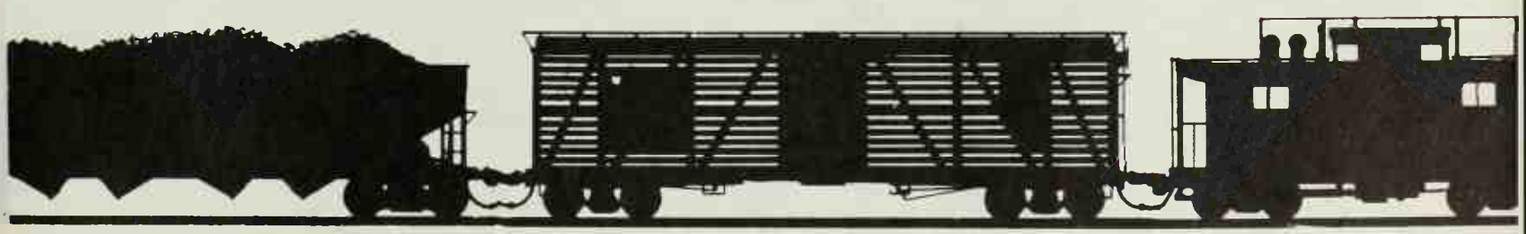
EVERYTHING YOU NEED TO KNOW ABOUT MODEL TRAINS

THOMAS Y. CROWELL COMPANY
NEW YORK



Thanks are due the following organizations who very generously supplied photographs of their model-railroading equipment: Bachman Bros., Inc.; the Lionel Division of Fundimensions, a Division of the General Mills Fun Group, Inc.; Tyco Electric Trains. The advice and assistance of Mr. Frank Crofutti of Blinn's hobby shop was also very helpful.

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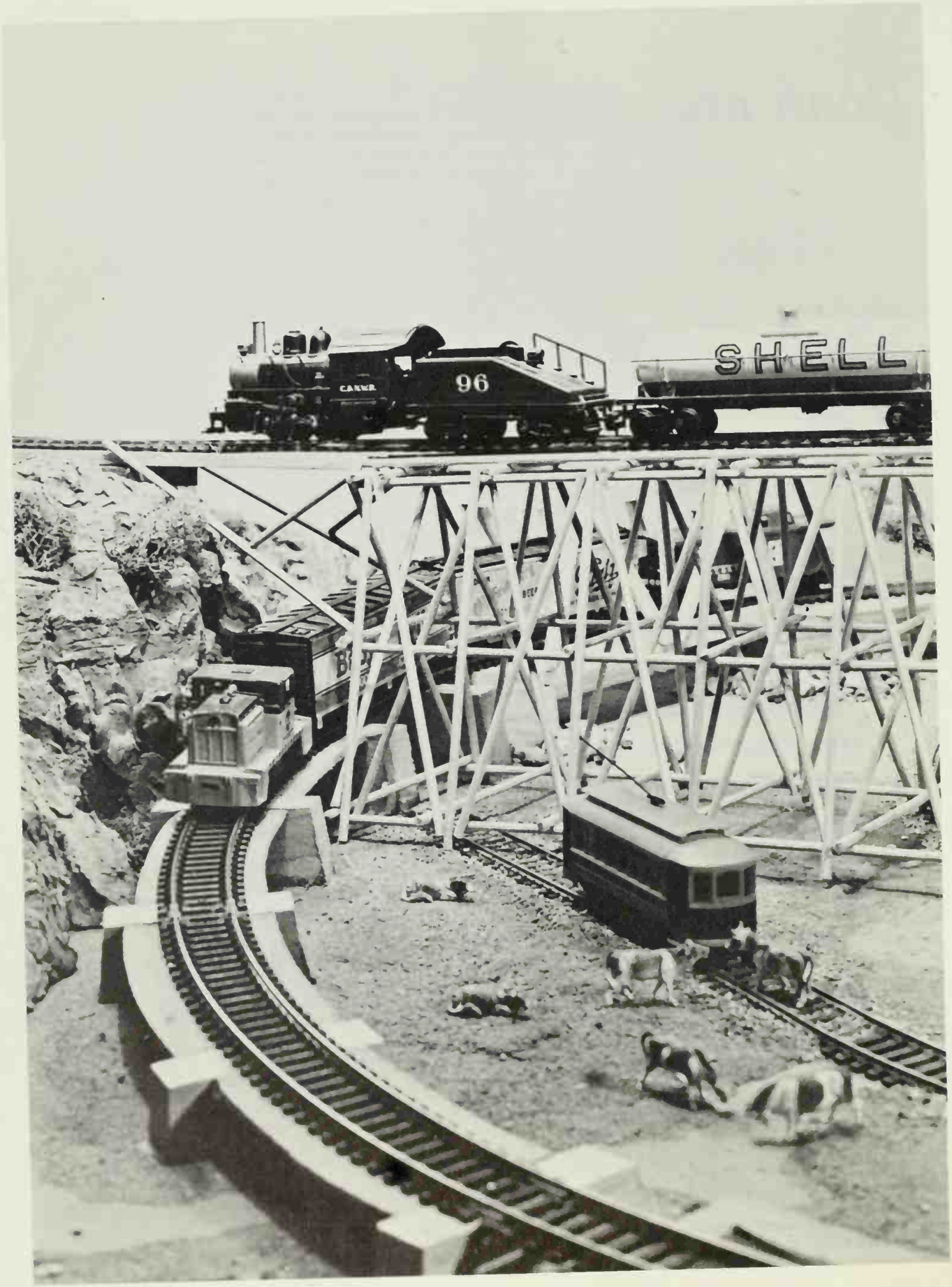
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SHELL

Introduction

I don't think there is anyone who doesn't like model trains. How could *anybody* not like model trains? I assume that you are particularly interested in them—otherwise you wouldn't be reading this!

This book also assumes that you hope one day to have a set of trains of your own; or that you are about to get a set; or that you already have the trains and are bored watching them go around and around and around and around . . . and you wonder if there isn't something more that you can do with them!

We will start at the very beginning and explain the basic facts of model railroading. And at the same time I will tell you about the model railroad that I built for myself. You'll be able to follow, step by step, the construction and then the expansion of a fairly simple layout. Perhaps, by seeing what I did—both the mistakes and the successes—you'll be better able to put together and operate your own model railroad in a way that will be continually interesting and challenging.

For many years model railroad trains were considered simply toys, playthings for very young children. Wind-up

trains and some of the electric trains produced years ago were crude and not very realistic. They were—and are—great fun. But model trains today are something quite different. The trains and equipment made now have the greatest detail, and the operation is smooth and efficient and in many ways very similar to a real, full-size railroad.

Some people take model railroading very seriously. There are some layouts that fill a large part of a room, with lots of track, many switches, entire towns, bridges, train yards, several locomotives, much rolling stock, and all this placed in very carefully landscaped settings. A model-train "empire" like this can take years to build and represents a good deal of skill and patience, as well as money.

If you find that, through the years, model railroading continues to keep your interest and enthusiasm, you may go far beyond the relatively simple operations and arrangements shown in this book. But that's something for the distant future. . . .

Model-Train Terminology

Boxcar: an enclosed car that carries all kinds of freight
Caboose: the last car of a train
Coupler: the device that attaches one car to another
Crossing: a section of track that allows a train to cross over a different line of track on the same level
Crossover: the arrangement of switches that lets a train shift from one track to another
Diesel locomotive: a locomotive powered by a diesel engine
Flatcar: used to carry large, bulky loads
Gondola: like a flatcar but with sides. It carries coal, gravel, etc.
Hopper: a kind of gondola, except that there are trapdoors underneath through which the cargo can be dropped.
Main line: This is the primary route from one place to another. The term is used mostly when there are several different tracks, and you want to distinguish the one used when a considerable distance is to be covered.
O gauge, HO gauge, N gauge: the three most popular sizes of model trains
Power pack: the control box for HO- and N-gauge trains
Reefer: a refrigerated boxcar

Siding: a short section of track that goes off to the side of the main track

Spur line: track that branches off to end at a location some distance from the main line

Steam Locomotive: Powered by steam, it is more old-fashioned than a diesel locomotive.

Switch: a device for directing a train off to the left or right

Switcher: any small locomotive used for shifting cars about in a train yard

Tank car: for carrying liquids or gases

Tender: a small car attached directly behind most locomotives. It carries fuel and water.

Transformer: the control box for most O-gauge trains

Trestle: a means to support elevated train track

Trucks: the system of wheels and springs that cars ride on

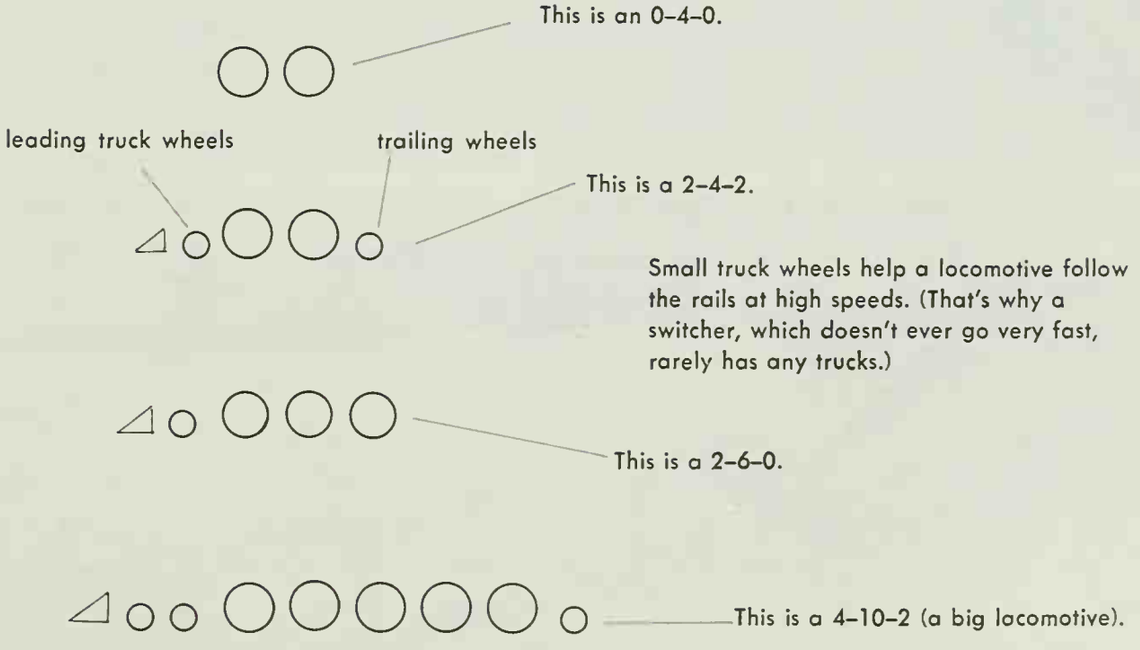
Locomotive Anatomy

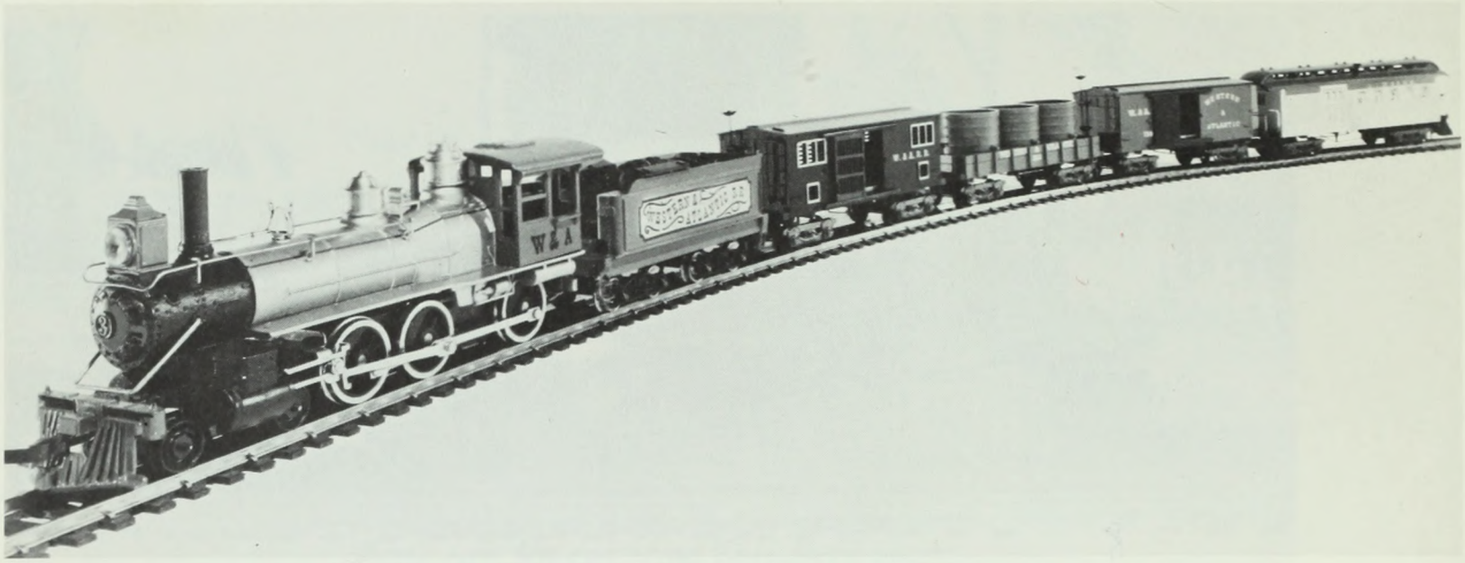
There are many different kinds of steam engines and they are usually described by the number and arrangement of wheels. There can be leading truck wheels and trailing wheels as well as the basic driving wheels.

When a locomotive is described with numbers, such as 2-4-2, the first number refers to how many leading truck wheels there are. The second number refers to the number of driving wheels. The third number refers to the trailing wheels.

The wheel arrangement is not mentioned when diesel locomotives are described.

This is an 0–4–0 steam engine and its tender. It is a "switcher"—so called because in real-life railroading it was mostly used for switching cars about in a railroad yard while assembling trains for a long run. The locomotive shown here is the one I used on my own model-railroad layout, which is described in considerable detail in this book. I used this locomotive not only for switching but for all kinds of work. Because it is an 0–4–0 (with just four wheels), it was able to get around sharp curves and was an ideal locomotive for railroading in a limited amount of space.

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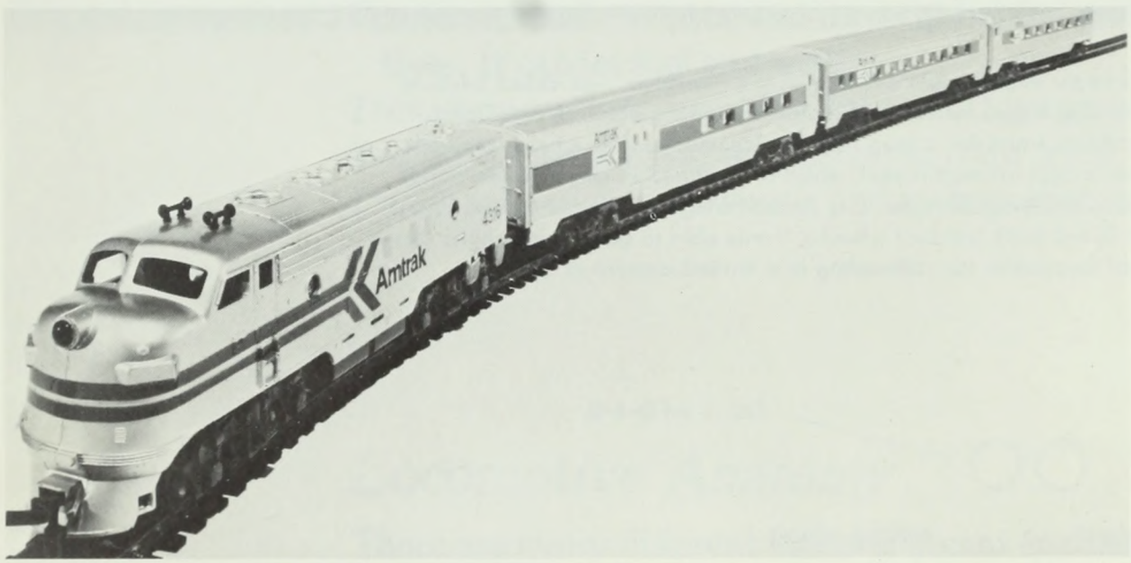
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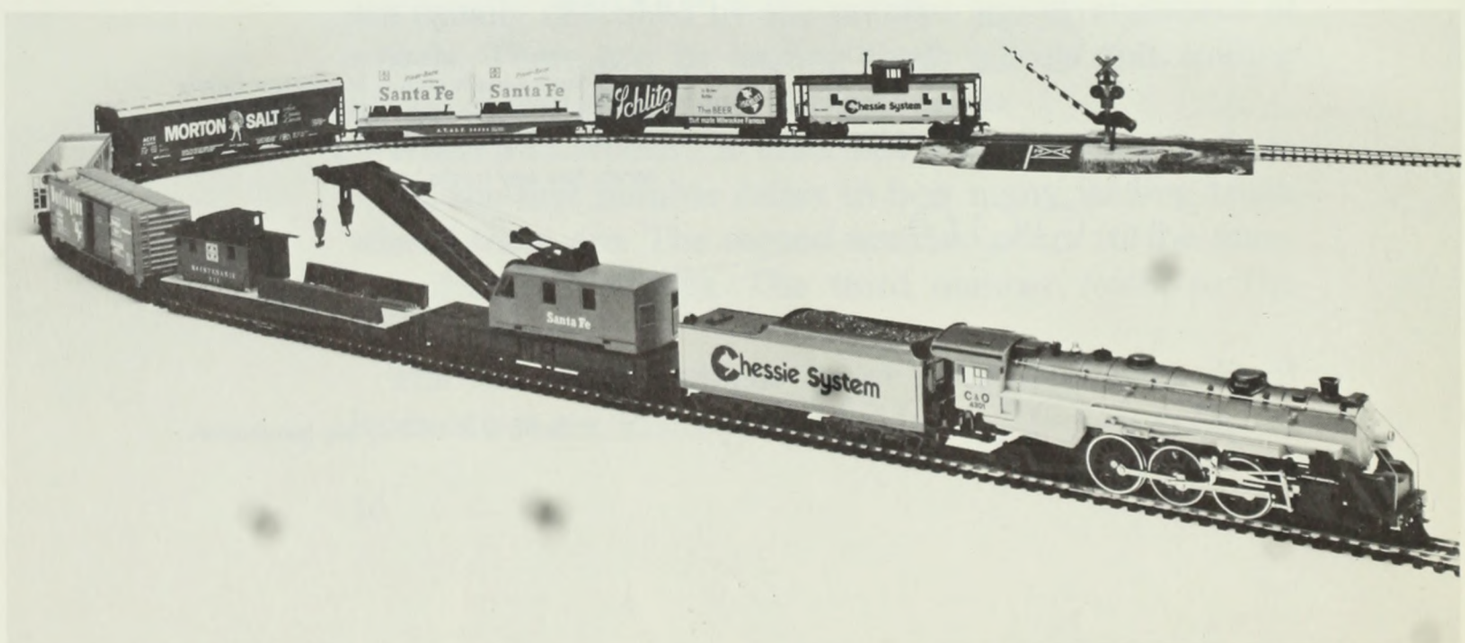
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1. What Kind of Trains?

Unless you already own a set of trains this is a basic and very important question to decide. There are three popular sizes of model trains: O gauge, HO gauge, and N gauge. "Gauge" refers to the distance between the rails.

O Gauge

O gauge is the largest size. The distance between O-gauge rails is 1¼ inches. A small steam locomotive might be 12 or 14 inches long and weigh three or four pounds. These are rugged trains. They don't have to be handled as carefully as the smaller sizes. They will take a good deal of rough use and still work well. O-gauge track comes in two sizes. One size is the standard O gauge. The other size is called O27. The O27 track is a little less tall and somewhat lighter in construction than standard O gauge. The distance between the rails, however, is the same. O27 is by far the most common type. If you were to get a set of Lionel trains (the most popular make of O-gauge trains), the track that would be included would be O27 gauge. It is called O27 because a circle of track is 27 inches in diameter. The locomotives and cars in this size will usually

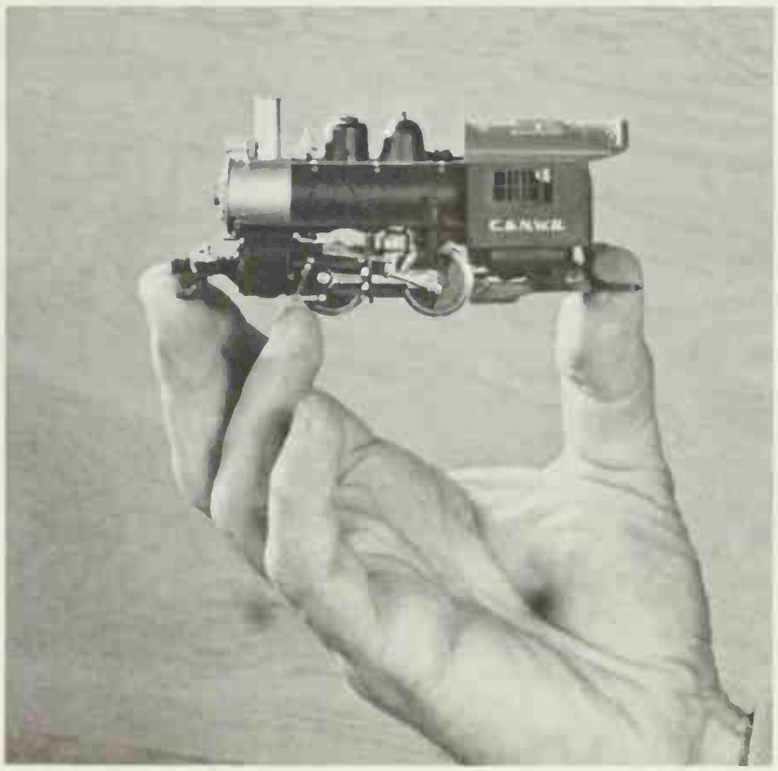
Here are three different kinds of trains. On top is an old-fashioned steam locomotive with tender and four freight cars. In the center photograph is a modern diesel passenger train. And at the bottom is a large freight train with a powerful steam locomotive. Trains like these are available in a complete package along with power pack and enough track to make a simple oval.

work on either kind of track, and in order to keep things simple, we will refer to all these large-size trains as O gauge.

There is one major problem with O-gauge trains. Because they are large, they take up a great deal of space. You could, of course, run your trains around a circle 27 inches in diameter, which is not much space. But if you want to expand into any kind of interesting track arrangement, you will need a lot more room. If you assemble the track on the living-room floor when you want to use the trains and take it apart when you're through, this gauge is fine. But if you want the track permanently assembled on a train table, with sidings and switches and landscaping, you would need a basement or attic or part of a room to house the layout.

HO Gauge

HO gauge is the most popular size today. (It is pronounced aitch-o.) The letters stand for half of O, or half the size of O gauge. The distance between the rails is



This will give you some idea of size.
This is our HO-gauge locomotive.

⅝ inch. A small locomotive might be 4 or 5 inches long and weigh about a pound.

HO is a good compromise between the O gauge, which can be a problem to keep set up permanently, and N gauge, described below, which for many people is a little too delicate and fussy. HO is large enough to be easily handled, and yet a lot of track and train activity can be squeezed into an area of reasonable size. One sheet of plywood (the standard size is 4 by 8 feet) is room enough for a quite elaborate layout. And you can do a great deal in even less space. The railroad I built is fitted onto a piece of plywood 3½ by 7 feet.

A great variety of accessories and equipment is available for this gauge because it is so popular. You can get many-wheeled locomotives, small diesel switches, old-fashioned types of trains, all kinds of tracks, switches, control towers, and just about anything you have room for, or can afford.

N Gauge

N gauge is a fairly recent development. It is about half the size of HO, or one quarter the size of O gauge. It is possible to build an elaborate layout in a small space. The only trouble is that the trains and other equipment are so small and so delicate they must be handled with the greatest care. To make adjustments or build accessories you need sharp eyes, a steady hand, and a great deal of patience.

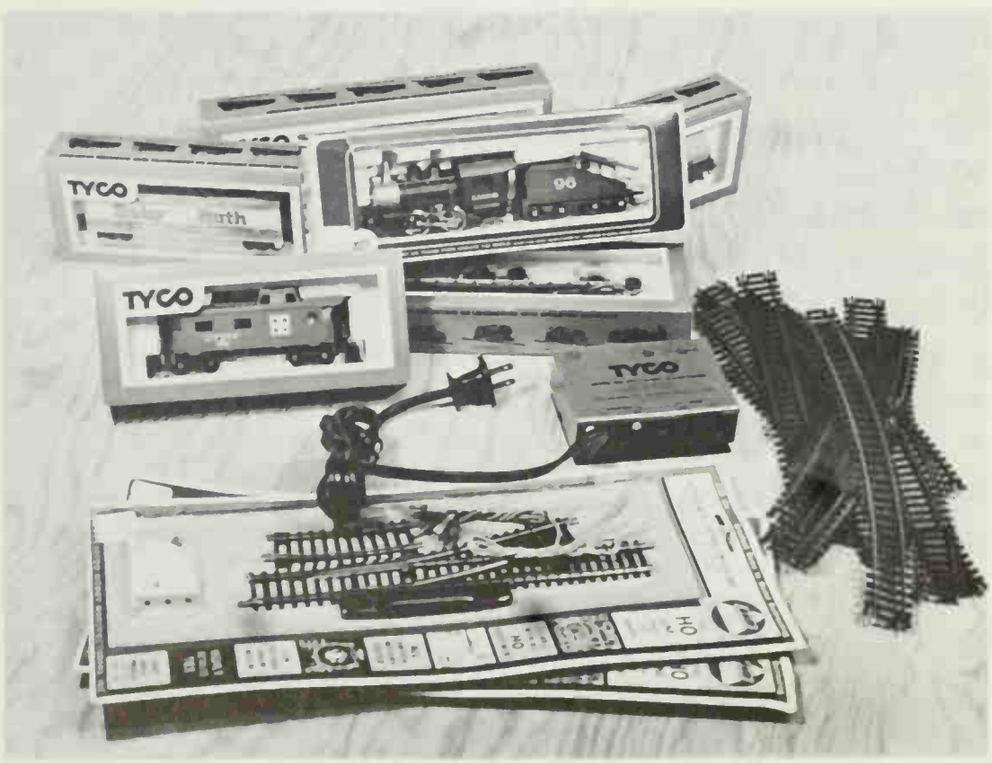
The main difference between HO and N gauge is size. The kinds of track, switches, and electrical controls are very similar. O gauge is different because the tracks have a third, center-power rail. Also the placement of the rail

ties (the crosspieces that hold the rails in place) is different. The ties are not as closely spaced. O-gauge trains also have a different kind of motor and control system. More about this in Chapter 3.

In all three of these gauges you can buy a complete set of trains in one package. This will include a locomotive, three or four cars, enough tracks to make a circle or oval, and a power pack. That is all you need to get started.

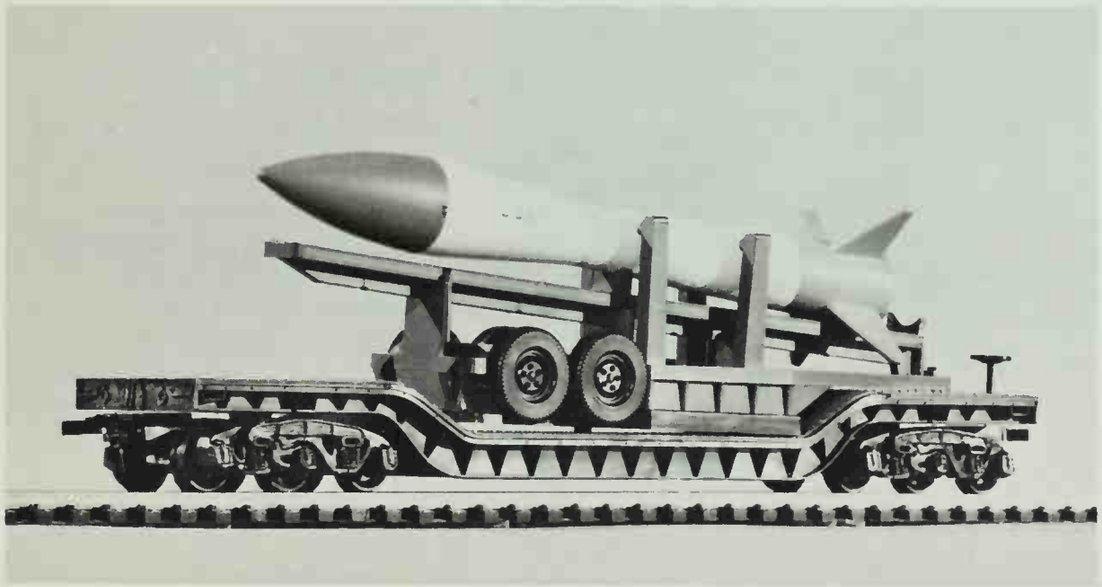
It is possible to buy the parts separately, choosing the amount of track and the type of cars and locomotives you particularly want. But there is such a wide variety of sets on the market you can usually have a large choice, and at the same time get a somewhat cheaper price, by buying the complete, packaged set. In some cases, the store may let you substitute one part for another. The set I bought came originally with a diesel engine. However, I preferred a steam engine. The store was able and willing to make the swap for me.

If you have friends with model trains, it is a good idea to talk the matter over with them before deciding on what to

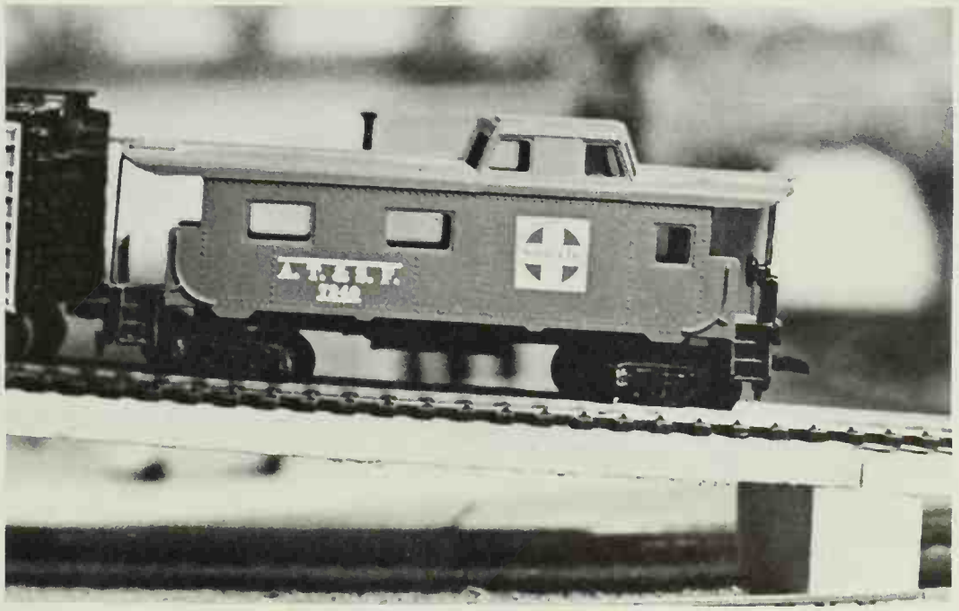


Here are the beginnings of a model railroad. There are four freight cars, a caboose, and the locomotive and tender. The power pack is the rectangular box in the center and to the right of that is a handful of straight and curved track. At the bottom are two switches.

This is a boxcar. Sometimes the name of the railroad to which the boxcar belongs is painted on the side; sometimes the name of the company owning it is conspicuously displayed.



An air-force missile on its trailer is fitted snugly onto a "dropped-bed" flatcar.

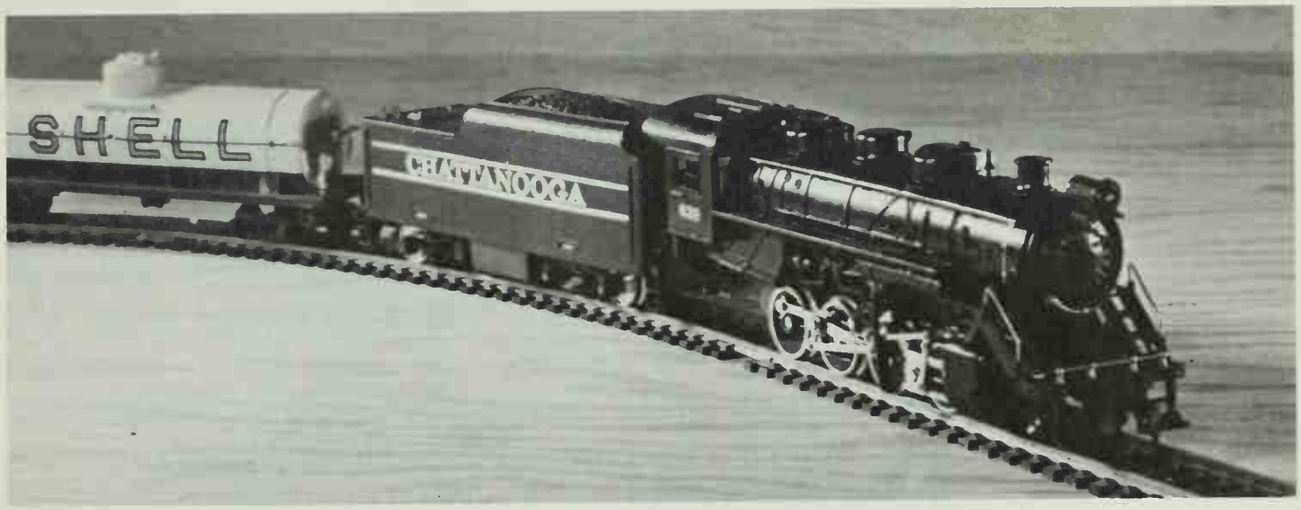


This is a caboose, a realistic and colorful car that belongs on the tail end of any freight train.

A small diesel switcher like this is about the most simple and inexpensive locomotive you can buy.

Here are six different locomotives in O gauge. You can tell they are O gauge by the track, which is three rail. Model trains are so realistic in all sizes that you can't tell from a photograph what gauge they are. In fact, sometimes you can't even be sure they aren't the actual full-scale train.

When there is a long, heavy train to pull, more than one locomotive is needed. Sometimes, when diesels are used, they are arranged back to back like this.



Here is a 2–8–0 locomotive and tender. You can see the many small parts and precise detail—right down to the rivets—that give a feeling of great realism.

get. Sometimes two or more people will join forces and combine their equipment to build a more ambitious layout than would be possible acting alone. If you think you may do this, you will want to have the same gauge trains as your friends so that everything will fit together.

If you are about to get a set of trains, there is another matter to decide besides the one of size. Do you want a passenger train or a freight train? This is a very important question.

There are many different types of passenger trains available. Some are handsome, old-fashioned types with steam locomotives. Others are sleek, streamlined affairs with powerful diesel engines. Some models have interior lights, which look beautiful when the trains are running in a darkened room. But if you have a choice, don't get a passenger train! There are several reasons. One major one is that long passenger cars and big locomotives don't look very well on small layouts with tight curves and short straightaways. They will be too big for their setting. You are also liable to have trouble when long cars and locomotives go through switches that are placed close together.

The average freight car is smaller and shorter than a passenger car and will look more realistic being pulled by the small locomotives which are best for small layouts.

The other reason for recommending freight trains instead of passenger trains is that there is more to do. The operation is more complex—and more fun. A passenger train can pick up and discharge passengers at stations, perhaps drop off a car now and then. But that is about all. A freight train has the job of picking up a variety of cargoes and delivering them somewhere. There are all kinds of loading and unloading possibilities. Freight trains have to be broken up into separate sections with individual cars left at sidings next to factories and small freight stations. They deliver raw materials—coal, lumber, various containers, oil—to all sorts of places along the line or on sidetracks (sidings). The arrangement and makeup of a freight train can present interesting problems. For example, what do you do when the second-from-the-end boxcar has to be dropped off at a siding to be loaded?

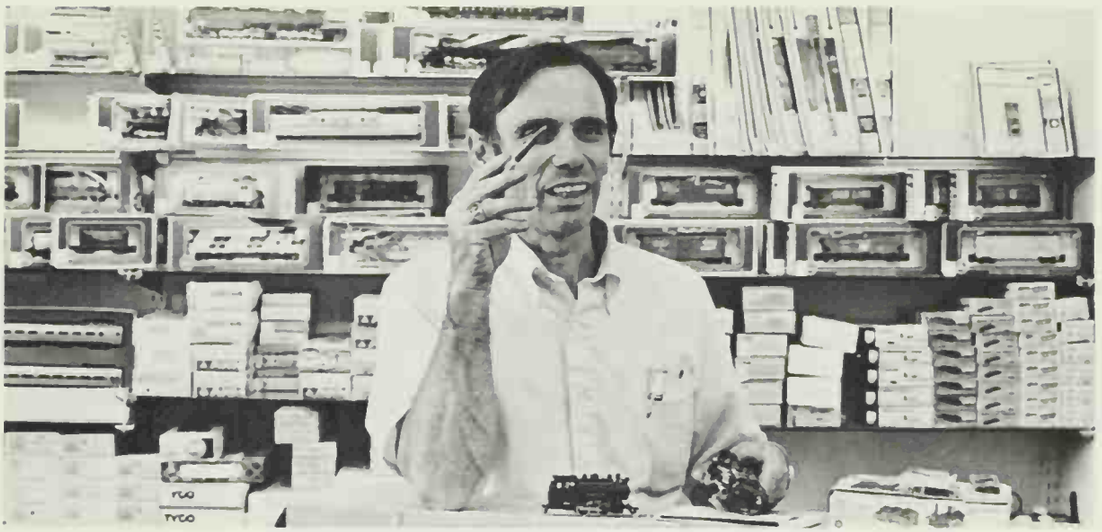
If you already own a passenger train, it is easy enough to keep the engine and get a few freight cars to use, in addition to the passenger cars. Leave the passenger cars on a siding until your "schedule" calls for a passenger-train run.

Because HO- and N-gauge trains are set up and controlled in very much the same way, and the main difference between them is size, we will, from now on, discuss only HO- or O-gauge trains. If you happen to have N gauge, you can follow the comments and information given for HO, making allowances for the size difference where necessary.

2. Where to Get Them

There are many places where model trains can be bought. Toy stores and some department and discount stores have packaged sets of trains for sale. But the best place to go is a hobby shop that has a model-train department. In a place like this you will not only have a good choice of trains, but you will find someone who knows something about model trains. This is very important. As you get your trains working and add on more track, switches, and accessories, you may want to ask questions, or you may need advice and help with problems you have run into. Unless you are at a hobby shop, you can't be sure you'll be dealing with anyone who knows anything about trains; and the prices at a hobby store will probably be about the same as anywhere else.

When I was putting together my railroad, I bought several switches from the hobby store where I had bought my original train set. When I installed them, I found they didn't work properly. The trains derailed as they passed over them. This was bad trouble, and I tried every possible adjustment. Nothing worked, so I took the switches back to the store and asked for advice. The dealer couldn't



The salesman in a hobby shop will usually have the answers to your questions.

figure out what was wrong either, but he thought that the particular batch of switches (which were supposed to be a sale-priced bargain from one particular manufacturer) were somehow defective. He lent me another well-known brand of switch to try out—and this switch worked fine. So I swapped all the original switches for the other type and had no more trouble. If I had been dealing with another kind of store, it is doubtful if I would have been able to get this problem straightened out so easily.

Some stores—especially cut-rate, super-bargain stores—may have low-priced train sets on sale. Look at this sort of thing with suspicion. The trains may actually be poorly made toys in an odd size, and nothing like the true-to-scale, well-built O, HO, or N gauge to which additional track and equipment can be added.

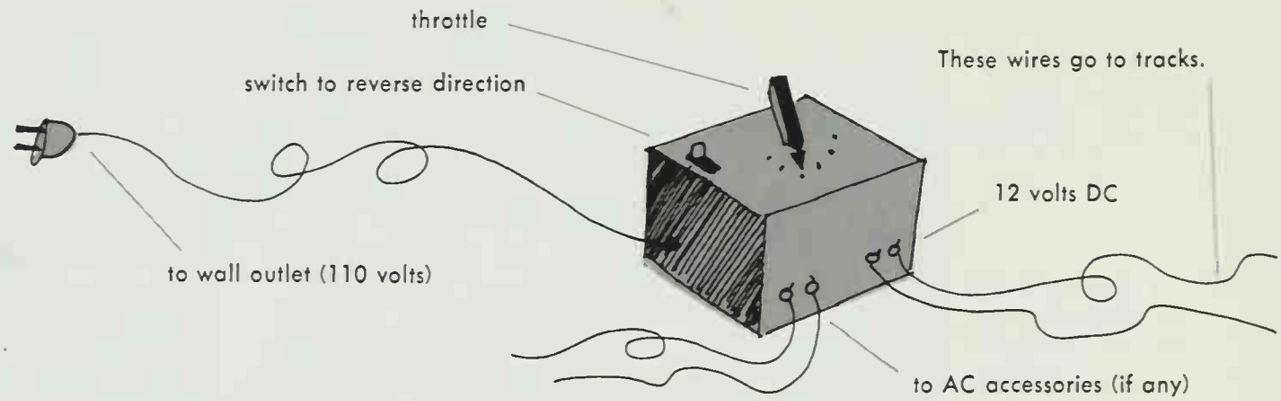
All trains and accessories bought from a reputable store are guaranteed. If something proves defective or doesn't work, it can be returned to the store or to the manufacturer. But occasionally you may run into a problem that can't be solved by simply replacing a part. That's when you want help from someone who knows about model trains—perhaps a friend, perhaps the salesman at a hobby shop.

3. How They Work

It is easy enough to assemble your train set, snap the tracks together, put the locomotive and cars on the track, connect the power pack—and off you go. But if you want to be able to handle any of the unexpected situations that develop with trains, or add more track and switches, and run your trains with a sense of knowing what it's all about, you should understand the few basic electrical facts explained here.

The electricity to run your trains comes from the usual household wall outlet. This is 110 volt AC (alternating current), which is fine for lamps, a TV, or the motor in your refrigerator or phonograph. But it must be changed before it can be used with model trains.

This is how it is changed for use with HO- or N-gauge trains: The current comes from the wall outlet and goes into the power pack. The first thing the power pack does is change the electricity by means of a transformer to a lower voltage—to 12 volts because 110 volts is dangerous. If you touch any bare wires or train tracks which are connected to 110 volts, you will get a very bad shock. But this is not the case if only 12 volts is being used. Twelve volts



is perfectly safe, and the motor of your locomotive is designed to work with this voltage.

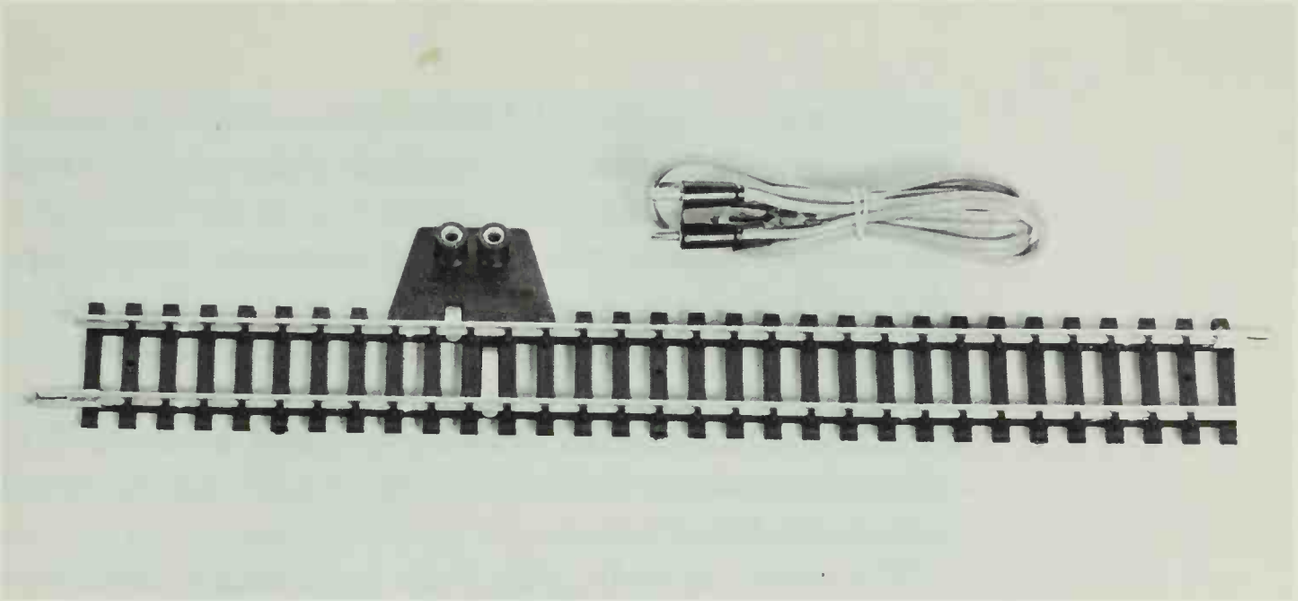
There is, however, a slight further complication. HO- and N-gauge locomotives use 12 volts DC (direct current). So the power pack has the additional job of changing the 12-volt AC current into 12-volt DC current. This is done by means of a little device called a rectifier.

All these mysterious but important operations take place inside the power pack. All you have to do is plug the power-pack cord into the house outlet, and then connect wires from the train tracks to two screws on the side or back of the power pack. These two screws will be marked "DC to trains," or perhaps "Connect to tracks."

On most power packs you will also find two additional screws marked "AC for accessories only." You would connect any lights or special accessories here. *But you must be careful* NOT *to connect the wires from the tracks to these screws.*

In order to connect the wires from the power pack to the tracks, you need a special section of track. It is called a "terminal" section. It will have two small screws or clips to which the wires can be fastened. Some train sets have little separate clip-on gadgets instead of a special track section.

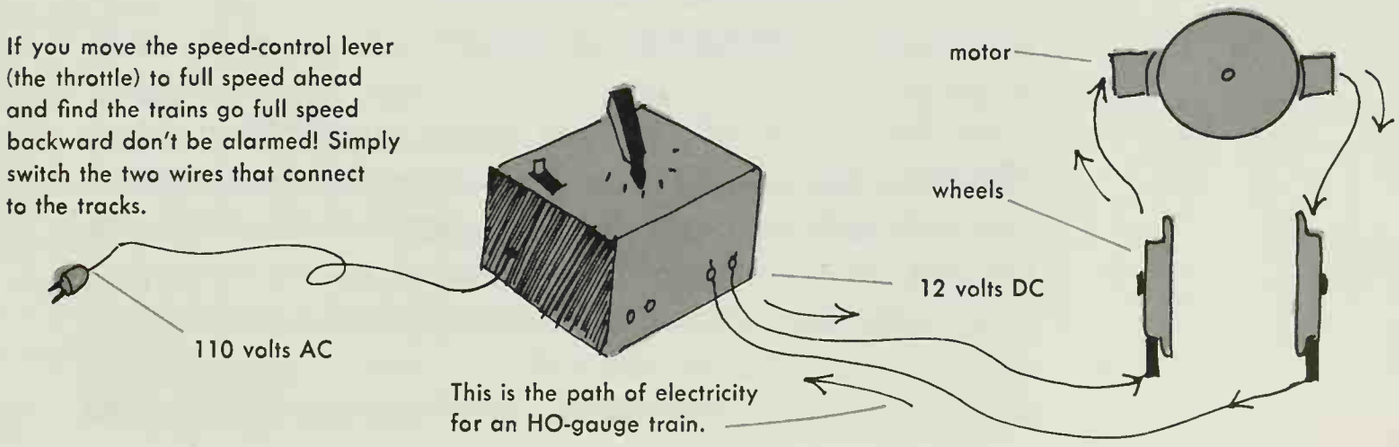
Now that the electricity is connected to the track, you



This is a type of terminal track where connections are made by plugging the wires into special receptacles, rather than by attaching the wires with screws or clips.

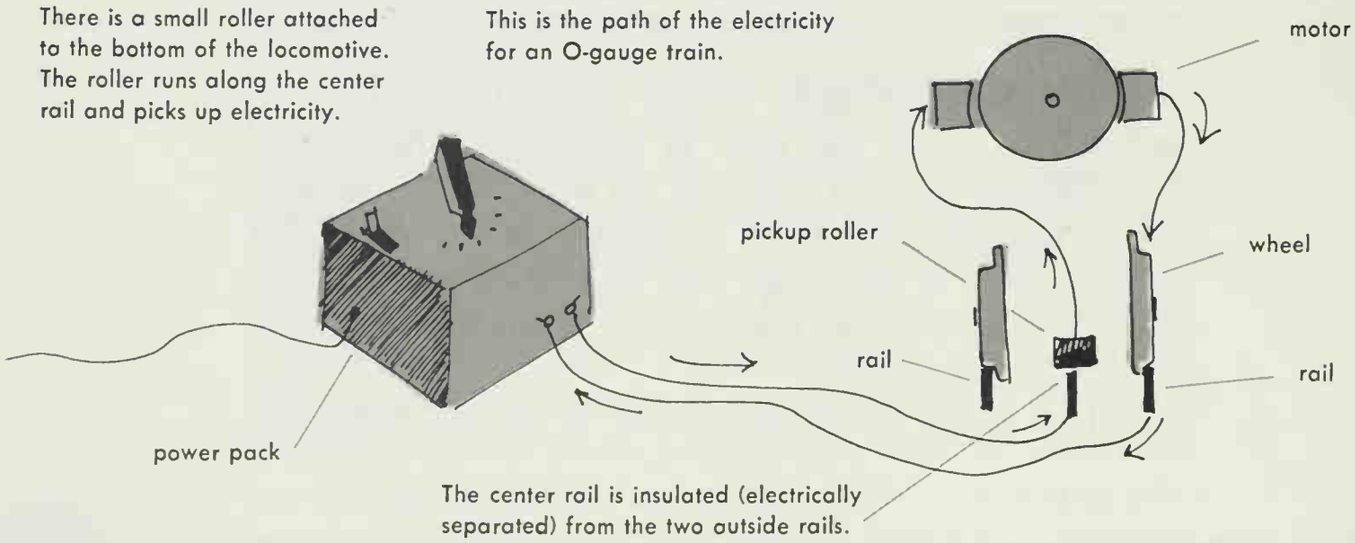
have two electrified rails. This is the path that the current follows when the train is operating: The current flows through one rail and into the wheel of the locomotive. It goes from the wheel to one side of the motor, out the other side of the motor, and to a wheel on the *other side* of the locomotive. Then it goes to the other rail and back to the power pack.

With O-gauge trains the theory is similar, but some



of the details are different. Most O-gauge trains use an AC motor. So instead of a power pack they use a transformer. This lowers the voltage, just as it does in the HO power pack. There is, however, no rectifier because the current does not have to be changed from AC to DC. The path of the current in a typical O-gauge train is like this: from the transformer to the *center rail*, to a small brass roller that is attached to the bottom of the locomotive, to the motor, out of the motor to *both* wheels, to the two outside tracks, back to the transformer.

The center rail of O-gauge track is electrically separated



from the two outside rails by means of stiff fiber paper. The two outer rails are joined to one another by the metal ties that hold the pieces of track together. So when you connect the wires from the transformer to the track, you must make one connection to the center rail, and the other to either one of the outside rails.

Some O-gauge transformers have a switch that is used

to reverse the direction of the trains. But in other models the reversing switch is on the engine itself.

In order for an electric current to do its job—in this case make the train motor turn—it must make a *complete* journey. There must be a complete circuit. If the circuit is interrupted anywhere, the current won't flow. The motor won't turn.

The throttle on the power pack or transformer is able to interrupt the current. If you turn it all the way to the left, the circuit is broken. When you move the throttle to the right, the current can flow. The throttle, however, is more than an off-on switch. It is like a valve that controls *how much* current will flow. The more you turn the throttle to the right, the more current flows and the faster the motor turns. In other words, you can control the speed of the train with the throttle.

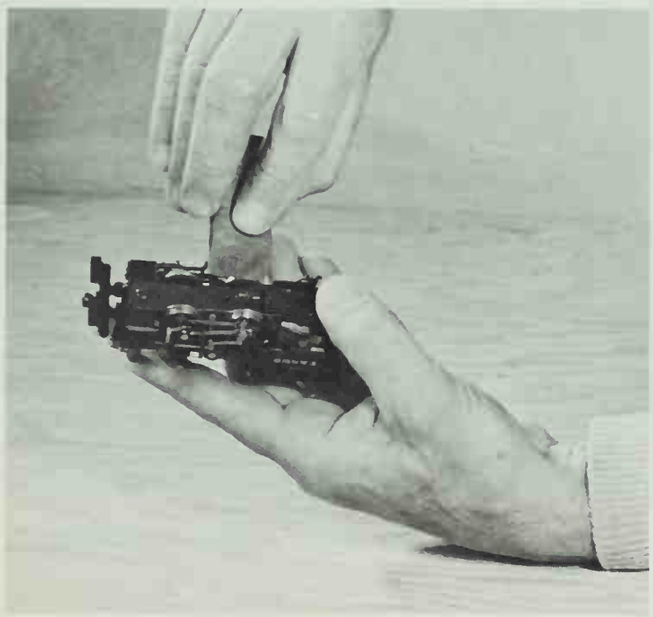
This is a simple power pack of the sort that comes with basic train sets.

There are many places in a model-train circuit where the current can be accidentally interrupted, causing the locomotive to run poorly or not at all. And this is one of the reasons you should understand some of the electrical principles discussed here.

Anything that will keep electricity from flowing, or not

conduct electricity, is called an insulator. Air, wood, plastic, paper, and glass are some of the many insulating materials. In HO or N gauge the railroad ties are made of plastic. If they were not made of an insulating material, the electric current would go from the power pack to one rail, through the tie to the next rail, and directly back to the power pack without going through the motor or doing any work. This is a short circuit. It is the same as putting a piece of wire directly from one battery terminal to another. The axles that hold the wheels of HO trains must also be nonconducting. If you had metal wheels connected to a metal axle, there would again be a short circuit. You will have the same situation if a wire or metal tool is laid across two HO rails, or from the center rail to one of the outside rails in O-gauge track.

Dirt is another insulating material. Dirt on the rails, even if it is just a very thin, scarcely noticeable layer, will cause trouble. It will prevent the electric current from getting from the rail to the locomotive wheels. When faced with trains that won't work or that work in a jerky, uneven way, an inexperienced model-railroad engineer will often assume that the locomotive is broken or that the power pack is out of commission. In most cases, however, the trouble is simply dirty or tarnished track or locomotive wheels. A careful clean-up and polishing will usually get the trains in action again. Even the most inexpensive power packs and train motors are well built and reliable. If everything is kept clean and handled with care, there is little danger of things going wrong. When not in use, trains should be put away where they won't gather dirt. And needless to say, they should never be tossed about or treated roughly.



cleaning the wheels of a locomotive with the pad that looks like an eraser

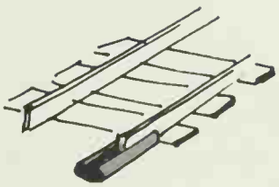
A Q-tip or bit of rag dipped in track-cleaning fluid will also quickly fix up dirty wheels. In order to turn the wheels and reach all parts (which you can't do by hand), send power to the rails and very briefly touch the locomotive wheels to the track.

Hobby stores have special cleaning solutions which can be wiped on tracks or wheels to keep them clean. You can also buy a special little pad that looks like a rubber eraser which is often used for cleaning. It has an abrasive mixed in with the rubber. However, the pad is awkward to use, and the liquid cleaner is better if you can get it.

Instructions for oiling will come with your locomotive. Follow them carefully—and don't overoil. Too much oil will gather dust and also drip onto the tracks, causing slipping.

Another source of electrical trouble is loose rail connections. If your trains are not permanently mounted and you disassemble them after every use, you will find that the connections will soon become loose. In HO and N gauge you can buy small brass connectors to replace the ones that have become loose. In O gauge you can, with the help of a pair of pliers, tighten the pins where they fit into the rail.

4. Trying Them Out

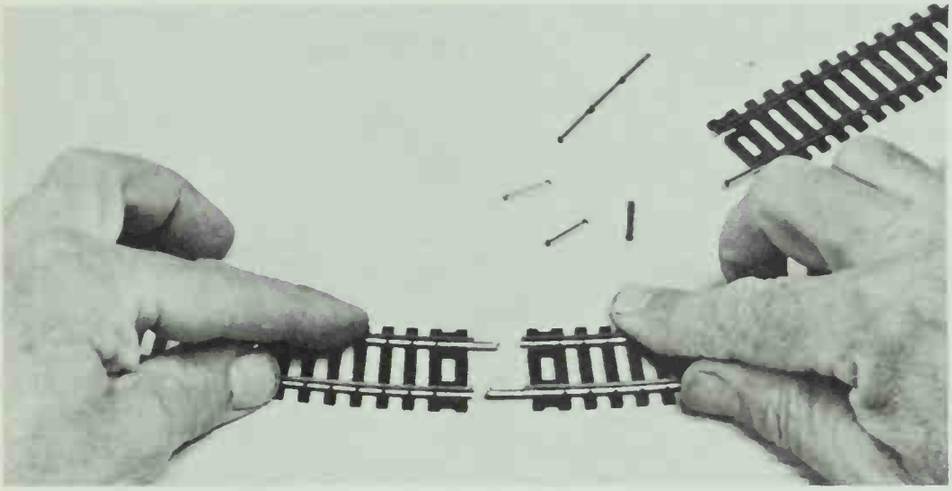


In order for HO- or N-gauge tracks to fit together, little brass connectors are needed. With some makes of track these connectors are already in place. But in other cases the connectors are packed separately, and you have to put them on the track yourself. Often the fit is tight, and you will have to work the connectors carefully into place. But don't get impatient with the job. The first time you try, it may seem impossible. If you take your time and don't use too much force, the track and connector will eventually go together.

a connector

When you join tracks to each other, it is best to work on a flat surface. *Slide* each track into the connectors. Try not to pick up the track section to do the fitting. This might bend the connectors and keep the track from lying flat.

One of the pieces of curved track that came with the set I bought was quite different from the others. It had a plastic section that looked like a road crossing. (Road crossings of some sort or other are needed where highways or

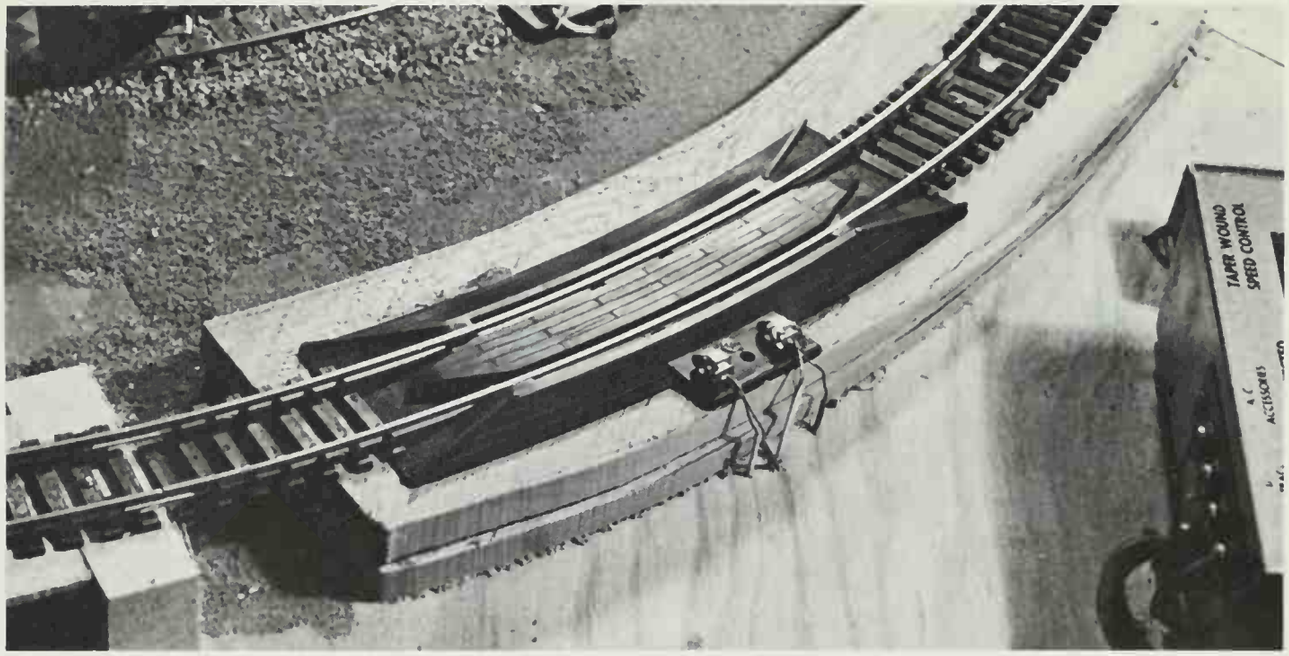


Two sections of track are being joined.

roads cross over tracks—just as in the real-life situation.) This piece of track was more than simply a road crossing, however. It was also a rerailer, which simplifies the job of putting the train wheels onto the rails. The wheels of HO- and N-gauge trains are small. It takes a little care and patience to get them all placed on the track properly. You will often think you have a car set in place only to start up the train and hear the rough bouncing that means wheels are on the ties rather than on the rails where they are supposed to be.

If you run a car over a rerailer, however, the wheels will be automatically set onto the tracks. The rerailer will save a lot of fussing and fiddling.

The particular road-crossing rerailer I had, performed still another function. It had two little clip-on connections so that the wires from the power pack could be attached to the track. There is no reason, except perhaps convenience, why a road crossing and a rerailer and electrical-terminal connections have to be all on one track



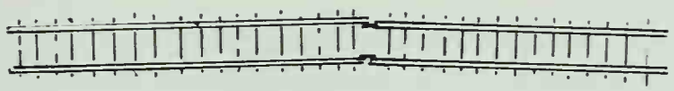
Here is a rerailer that is part of a curved section of track. In this particular case the track has been wedged up at the beginning of an incline. You can also see two clips to which the wires from the power pack are attached.

section. Different manufacturers will do it in different ways. If you want, you can buy a section of track that has only a rerailer on it, or only terminal connections.

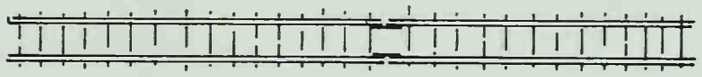
When all the track has been connected, run your hand over the joints. If the end of a piece of track sticks up or if you feel the sharp corner of a rail, you don't have the connectors properly attached. Pull the track apart and try again. The track should be level, with no unevenness, sudden bends, or large gaps.

O-gauge track, being larger than HO or N gauge, is a little simpler to put together. This kind of track uses a system of pins instead of brass connectors.

There are a few things to keep in mind when first setting up model trains. If they are HO or N gauge, they should not be operated with the track placed on carpet or rug. The dust and lint will quickly get into the wheels and



bad



good

Tracks must be arranged in straight lines or continuous, even curves if the trains are to travel in a smooth and realistic fashion.

gears of the locomotive, and cause all kinds of problems. One train manufacturer, in fact, will not guarantee its locomotives if they are operated on a rug or carpet.

Another thing to remember is that electrical connections, as well as mechanical connections between track sections, are made by the little brass connectors. The fit must be snug and tight if the electricity is to flow with no interruptions.

If you continually connect and then disconnect the tracks, these connectors will eventually become loose and you may get little air gaps that will act as insulators. As already explained in the previous chapter, a gap in the path of the electricity is like an open switch. And if the electricity doesn't get to the motor, it won't run. The connectors can sometimes be tightened with a pair of pliers. Or they can be replaced. One of the reasons for keeping tracks permanently fastened to a piece of plywood is that they will stay firmly connected this way. There is no chance for them to work loose. If you do have to take tracks apart, try to keep them in three-, four-, or five-part sections. This will make for a little less wear and tear on the connectors.

The NP & H

There was one more thing I had to do at this point, and that was to find a name for my railroad. Usually the name of some well-known line such as Union Pacific or Santa Fe or New York Central is already painted on the locomotive. But that is no reason not to have a name of one's own choosing to dignify the railroad.

I decided that my railroad would eventually have at least two towns through which it would pass, and these would provide the name for the railroad line. I decided one town would be named North Piddleton (which sounded small, but quite serious) and the other Happenstance (which means a chance or accidental occurrence—I was sure there would be a lot of that). And so I named my railroad the North Piddleton and Happenstance Railroad, or abbreviated, NP & H.

This is a plastic, store-bought freight station. If you use something like this, you con hand-letter your own sign and attach it in an appropriate place. Actuolly I prefer to use cardboard stations which I build myself.

Operation

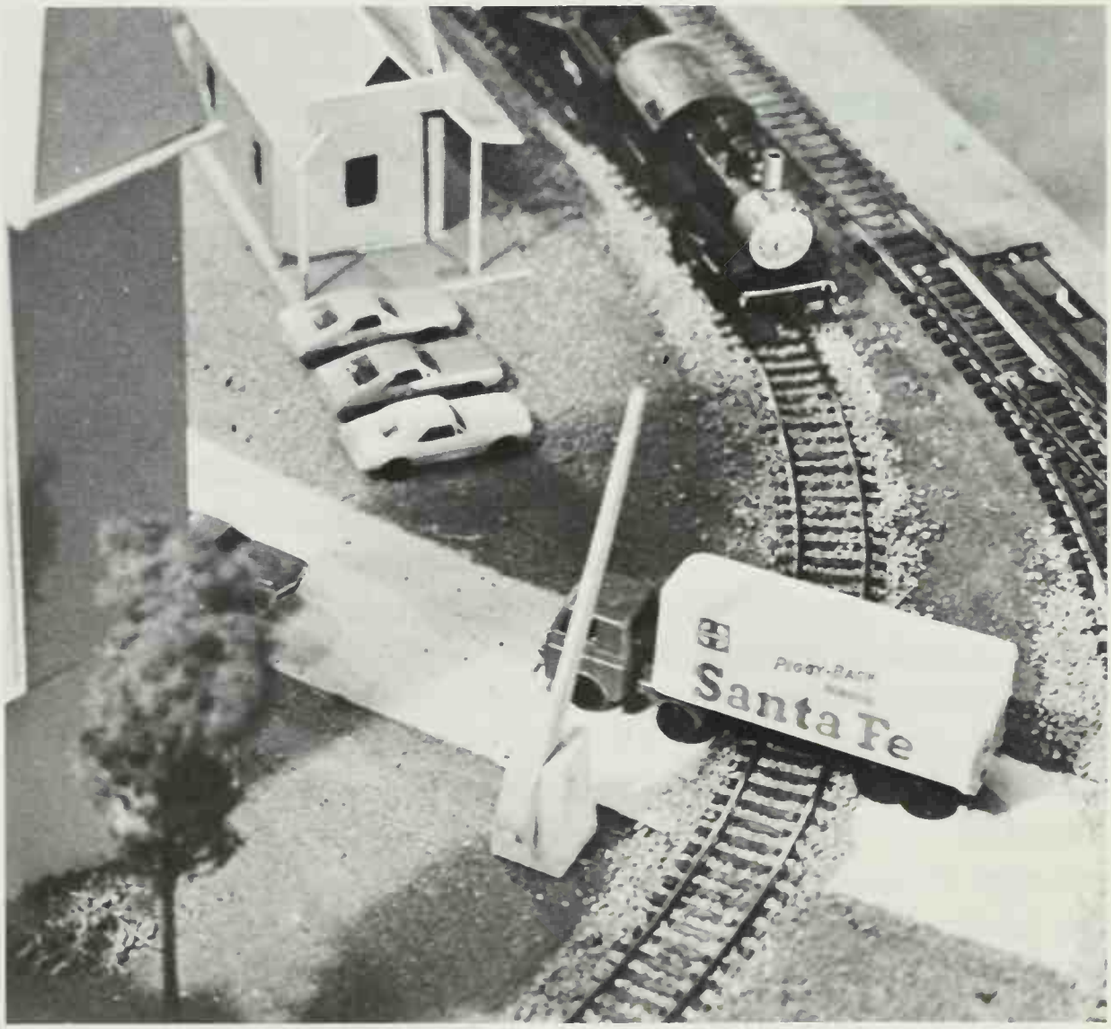
When you run model trains, you should use a gentle hand on the throttle. There is a temptation sometimes to run your trains at top speed with the throttle wide open. But this is not realistic operation. On some sets with the throttle moved to its maximum, the train would produce a speed equal to about 200 miles per hour on real track. No train goes that fast.

A train running at top speed all the time is not only unrealistic, but it is more liable to derail. A derailment may be an interesting and dramatic event. But it won't do your train any good at all. It will scratch the paint, perhaps break the couplings, and can cause damage to the motor and some of its more delicate parts.

Realistic operation also requires that you slow down for switches, road crossings, bridges, and sharp curves. When there is a direction-reversing switch on the power pack, it should be used only after the train has been brought to a full stop. Stops should be made gradually, and all switching, backing, and coupling operations should be made as slowly and gently as possible.

Some of the less expensive power packs (or transformers in O gauge) cannot run a train at very slow speeds. This is unfortunate because one of the nicest things in model-train operation is watching a train as it slowly picks up speed or gradually slows down, and as it inches about on its various switching maneuvers.

The purpose of model railroading is to create an illusion of actual, real-life railroading. If you run your trains at top speed, banging them about from here to there with no purpose, the trains become merely toys which you'll quickly tire of.



The skilled model-train engineer doesn't keep his trains always running at top speed. And he is always on the alert for trouble—such as the trailer truck stalled on the main line!

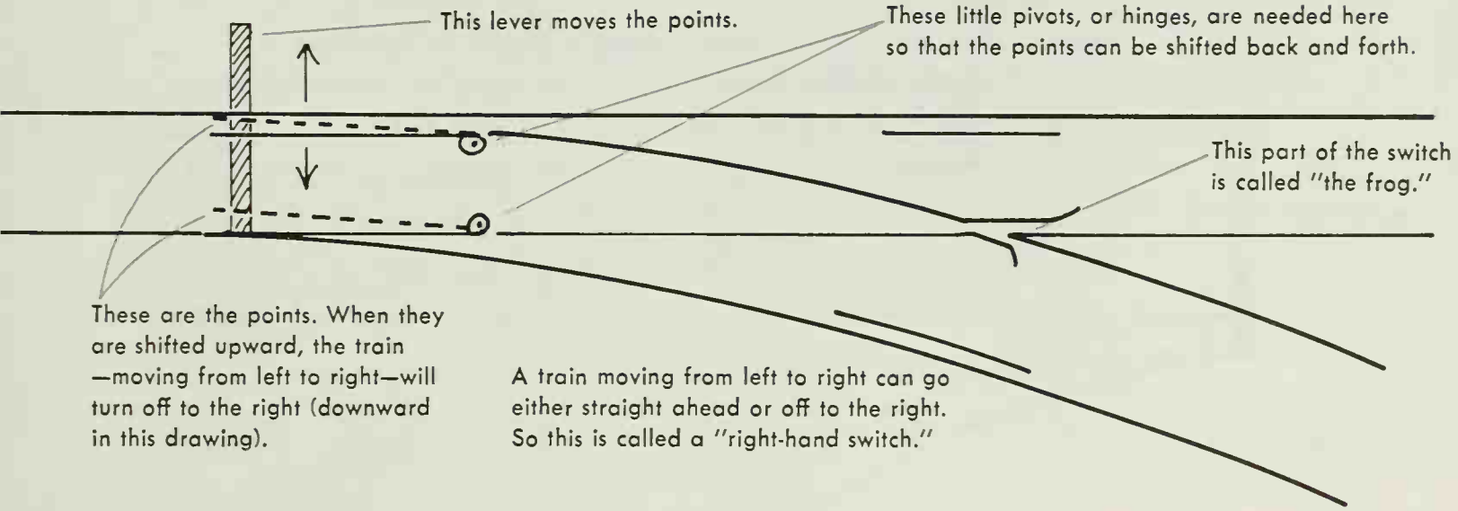
If model railroading is to provide a continuing interest and pleasure, you should build up in your imagination a setting, a purpose, and a type of operation for your railroad. More about this in later chapters.

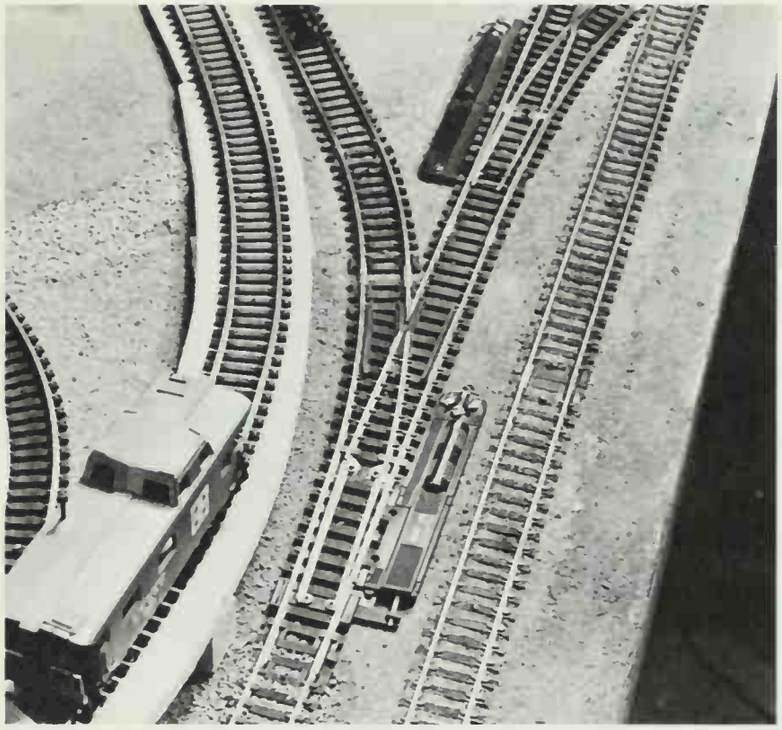
5. Switches and Coupling

Switches

Switches are needed to turn a train off onto a different set of track. One of the most interesting activities in model railroading is the switching about of trains. Without switches you are pretty much limited to simple round-and-round running.

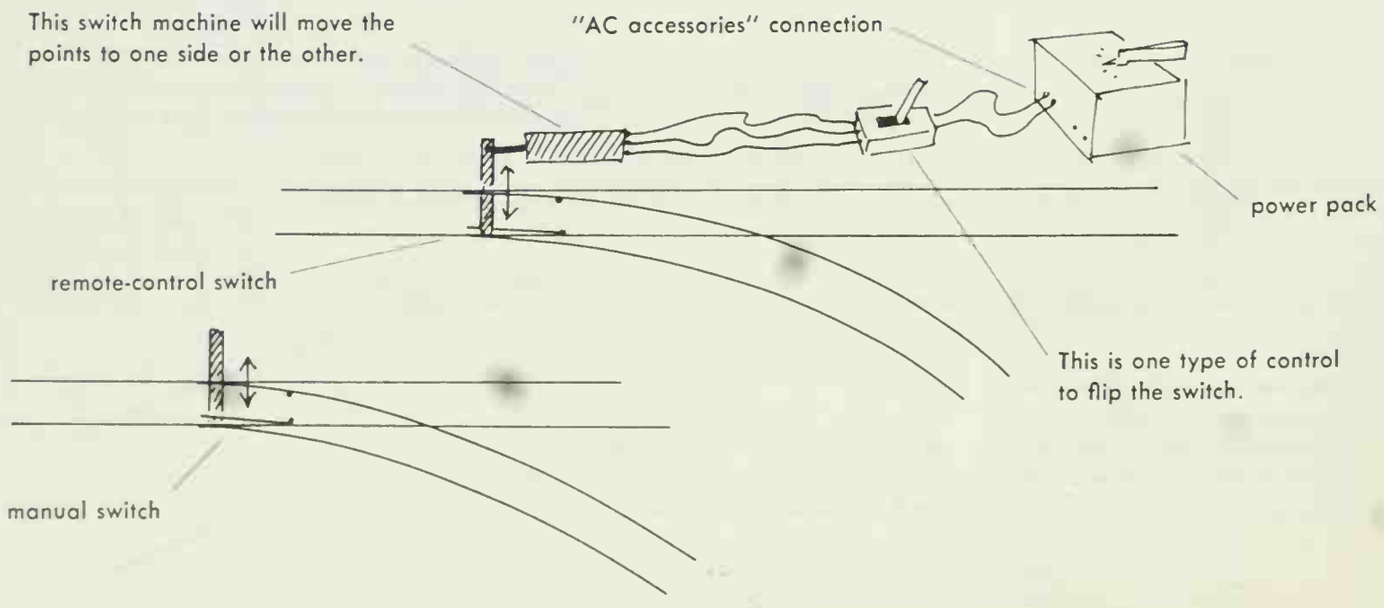
Every switch has two short lengths of movable track called "points." The points are connected together and move as a pair. The position of these points determines whether the train is to go straight or off to the side. There are left-hand and right-hand switches. A right-hand switch can turn a train off to the right; a left-hand switch will turn it to the left.





This is a left-hand remote-control switch. The narrow plastic housing on the side controls the little mechanism that flips the switch one way or the other. (The way the points are positioned now, the train will turn off to the left.) At the top of the photograph is a right-hand remote-control switch.

The switch is worked by flipping a little plastic lever one way or the other. Switches can be worked by hand, in which case they are called manual switches. But they are also available with a remote-control mechanism. This kind of switch is connected by wires to a control button, which is in turn connected to the power pack. The connection is made to the screws marked "AC for accessories." The switch is an accessory. Directions for hooking up a remote-control switch will come along with any switch you buy. The arrangement shown below is typical.



Remote-control switches are especially handy for places on the far side of your layout that are hard to reach. When the switches are nearby, you can use a manual switch and reach out a hand and flip them as needed. Remote-control switches complete with controls and hookup wire will cost about four or five dollars, manual controls about two dollars less.

O-gauge switches work on the same principle as HO switches, but they look a little different. They usually come mounted on a plastic base and in general have a more massive appearance.

Coupling

The process of joining or attaching one car to another is called "coupling." The little gadget that holds the cars together is called the coupler. It is a delicate but efficient device, and you should treat it with care. A car with a broken coupler is of not much use for anything.

There is a coupler at each end of every passenger and freight car as well as on the locomotive. When one car is pushed up against another, the couplers will automatically engage. If there is a car on a side track that you want to pick up, all you do is gently back up the train until it bumps into the car. You must be careful not to back up too fast and bump hard, or the car will be derailed. Then move the train forward. The car will be firmly attached.

Uncoupling is more complicated. You can, of course, pick up a car by hand and uncouple it with a careful, twisting motion. But this is a very unrailroad-like way to do it. And you will be left with a car in your hand that has to be rerailed. There is also a chance that you may damage the coupler. If you must uncouple a car by hand, do it carefully.

O-gauge couplers are large, so that it is fairly simple to flip the coupler open with a fingernail. If you examine an O-gauge coupler carefully, you'll see just how to do it. O-gauge couplers can also be opened by means of a special, remote-control uncoupling track. The train is moved over this special section of track; a button is pressed; the cars separate. What happens is that a little electromagnet is activated when the button is pressed. This pulls down a part of the coupler, opening the connection.

There are also some types of HO uncouplers that work by magnets. But these are rather specialized and are used mostly by people with very elaborate train systems.

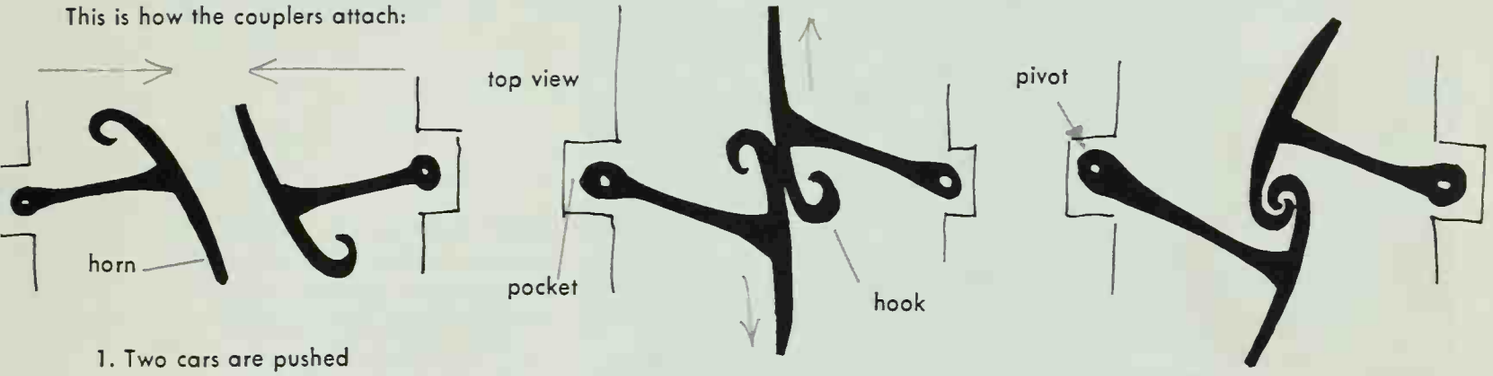
Here is the way HO uncoupling works. The usual HO coupler has a little plastic pin projecting down. There is one on each coupler. In other words, when two cars are coupled together, there will be two pins between the cars. When these two pins are pressed in from the sides—toward one another—the couplers will open. The cars can be rolled apart.

These pins are small and just about impossible to reach with your fingers. However, they can be reached with two thin strips of wood. I find that a clothespin works well. Get one of the spring type. Remove the spring so that you have just the two wedge-shaped pieces of wood. If they seem a little too bulky, whittle or sand down the ends. (You can also use Popsicle sticks or whittle something similar from any scrap of wood.)

Rest the wood strips on the tracks and push them gently toward one another, causing the coupler pins to move inward. With the couplers open, you can use one of the strips or a finger to gently nudge the cars apart. In order for this operation to work, the cars must be pushing up

These are simplified drawings of an HO train coupler.

This is how the couplers attach:



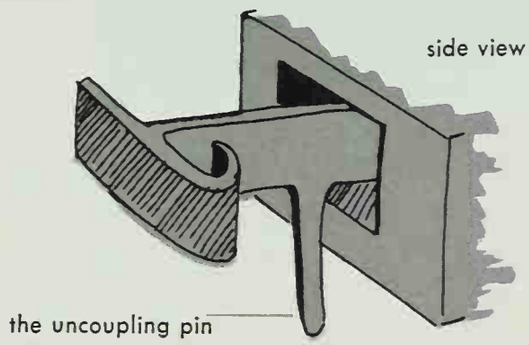
1. Two cars are pushed toward one another.

2. The horns touch, and the couplers shift to the side.

3. The hooks catch on to one another, and the cars are connected.

If you pick up two cars and watch carefully as you slowly couple and then uncouple them, you will be able to see just how this tricky little action takes place.

Couplers are delicate and must be handled carefully!



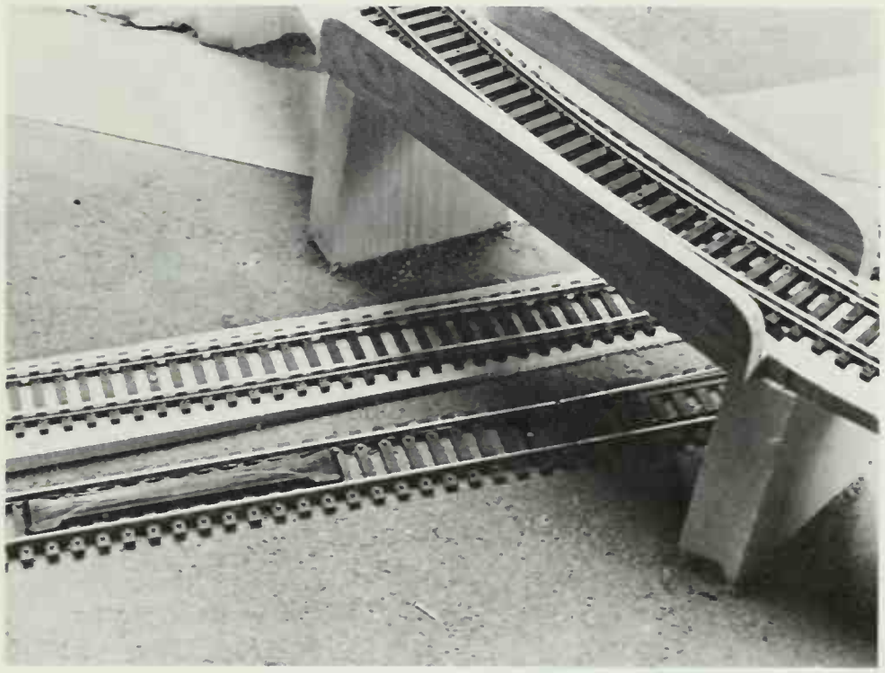
The base of the coupler fits into a "pocket," which is part of the car.

The uncoupling pins are pushed toward one another to disconnect the two hooks.

against one another slightly while the pins are being pressed in. If the cars are being held apart, with tension on the coupler, they won't separate.

Uncoupling may sound difficult, but it isn't. The first few times you will find it awkward. But experiment with the wood strips directed in at different angles until you find the easiest way to do it. Use an extra finger or two to keep the cars pushed together, and you'll soon be able to uncouple any car quickly and smoothly, with a minimum of fuss.

HO trains can also be uncoupled automatically with the aid of an uncoupling ramp. This is a special section of



Here is a section of track that contains an uncoupling ramp. When a train passes over this, stops, reverses briefly, then proceeds on its way again, all the cars behind the ramp will be separated from the rest of the train. A large model railroad may have several of these inexpensive and useful gadgets placed in train yards and on sidings.

track that contains two small springy wires. The wires push the pins together, just as you would do with the two thin strips of wood. If a train is passing straight through a section of track with an uncoupling ramp, nothing will happen. The train has to stop, momentarily reverse direction, then continue on if the cars are to uncouple. Uncoupling ramps come with a special little remote-control button that, when pressed, causes the train to stop, reverse, and continue on, leaving the uncoupled cars behind. Instructions for the installation of this button will come with the ramp.

If the uncoupling ramp is on a downward incline, you may be able to uncouple without this reversing button. Stop the train with the couplers on the uncoupling ramp. The car on the uncoupling ramp and those below it on the slope should roll away.

6. Track Plans

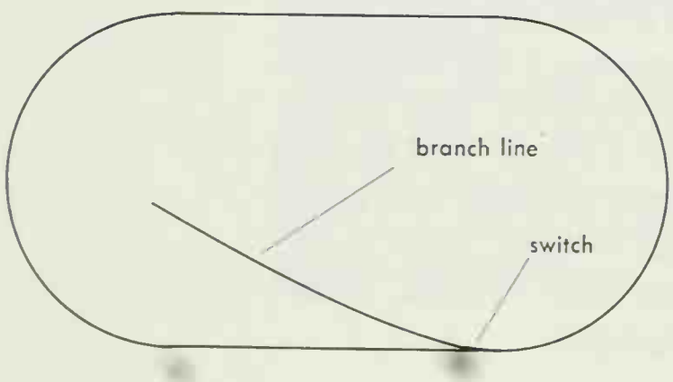
A simple oval isn't enough. I found that my freight train, temporarily set up and running around and around, just wasn't able to hold my interest for very long. I put down a few blocks of wood to represent railroad stations and assembled a few odds and ends for freight. Then I was able to ship freight from one station to another. But this was pretty far removed from the sort of operation that a real railroad might be involved with. There just wasn't enough to do.

So this was the time to make some long-range plans. I knew it was not a good idea to jump from a simple, basic loop into a very large, complex layout. It is too easy to make all kinds of bad judgments and mistakes that way. The right way to create a layout is a little at a time, gradually expanding and improving. However, I did want some general idea of how the NP & H would grow. And I could always change my mind—as I knew I would. Half the fun of model railroading is the continual planning and building of more or different tracks and settings. Most model railroaders are never through with their layouts. Something is always being planned, or changed.

The first decision I made was to mount the tracks on a plywood board. The standard size of a sheet of plywood is 4 by 8 feet. This is a fine size for model trains, and additional track could easily be added on at some future time. All kinds of interesting track layouts would fit. But then I looked at the space where I intended to set up the trains and where the plywood would be stored when the trains were not in use. The biggest space I could comfortably manage was about 3½ by 7 feet. With this size in mind, I set about finding a suitable track plan.

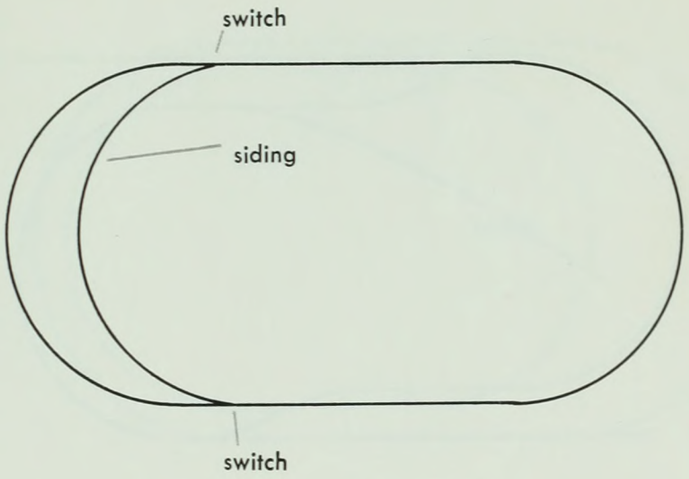
When the available space is limited, the track arrangement is also limited. But at this stage I didn't want to get involved with difficult construction or complicated wiring anyway. At some later time in the future I could expand into a more elaborate track plan that would permit the operation of two trains at the same time and more complex switching. I knew I wouldn't have room on the board for an outer oval of tracks, but I decided I didn't mind. Chapter 11 goes into this in more detail.

Some simple track plans that will fit into limited space are shown on the next few pages. Most of them are suitable for any gauge, though obviously O gauge will need a lot more space than HO, and HO more than N gauge.



1. This is a simple variation on an oval. It requires one switch and a few additional pieces of track to make the branch line.

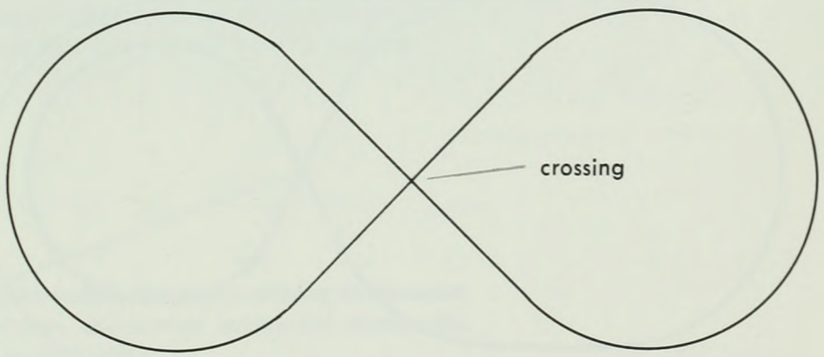
2. A loop with a siding. Two switches are needed.



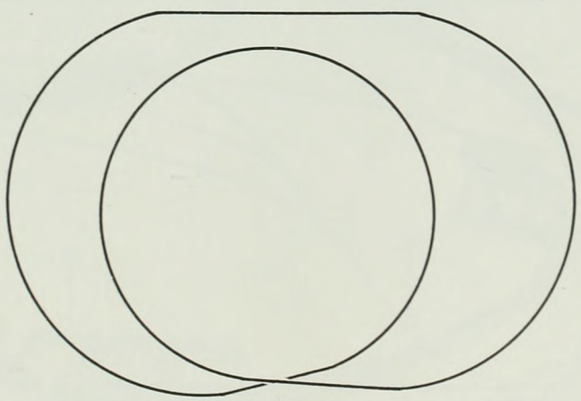
You can simplify the drawing of track plans by using one single line to indicate where the tracks go. There is no reason to draw both rails.

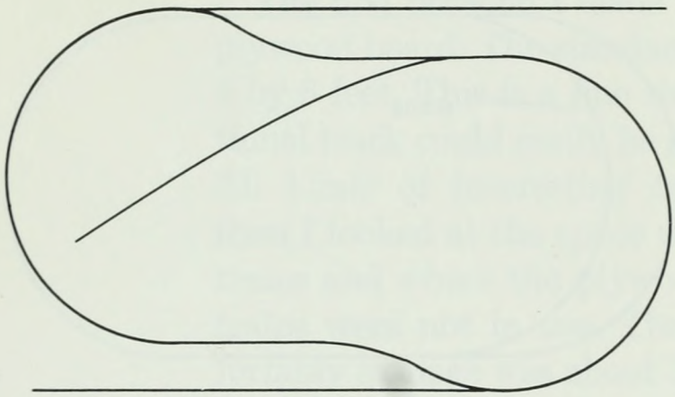
The plans shown here are for one-train operations and need no special wiring arrangements.

3. A special track crossing is needed for this plan if the track is kept on one level. It is, however, much more fun to raise one part of the track so that it crosses over the other part. Then you have a reason to build trestles or a bridge.

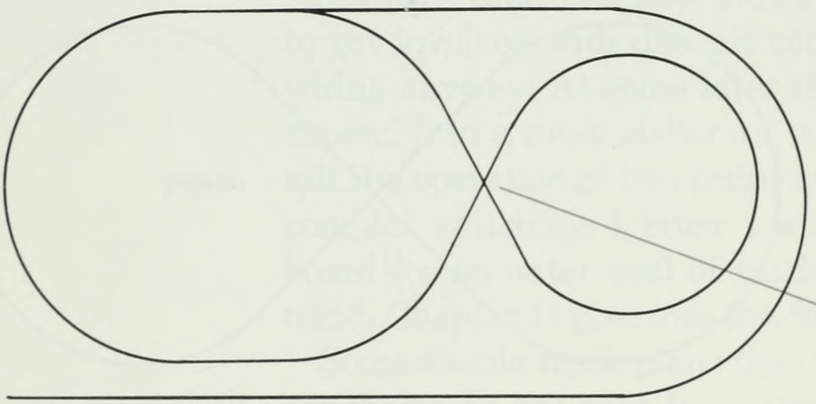


4. This plan will fit into the smallest possible space. One loop can be gradually elevated to pass over the other.



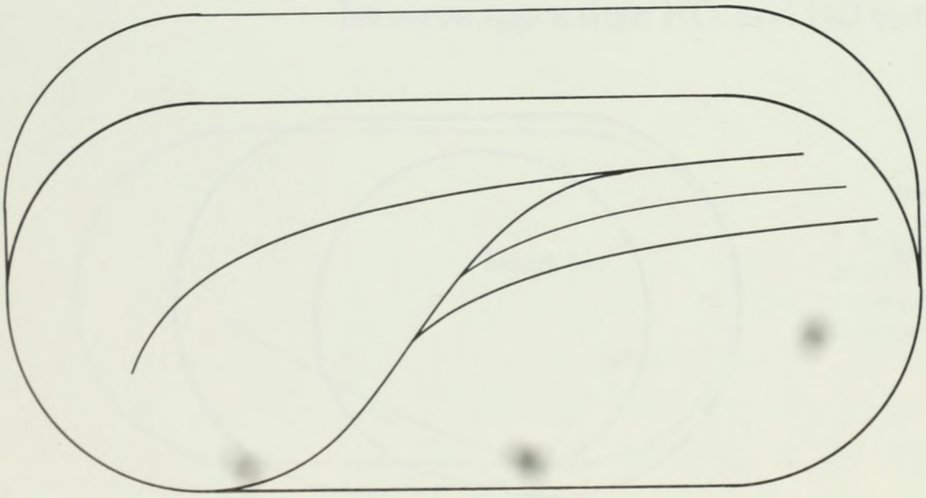


5. Several short lines (sometimes called "spur lines") branch off the main line. This plan would allow lots of freight shipping between factories and terminals placed at various locations.

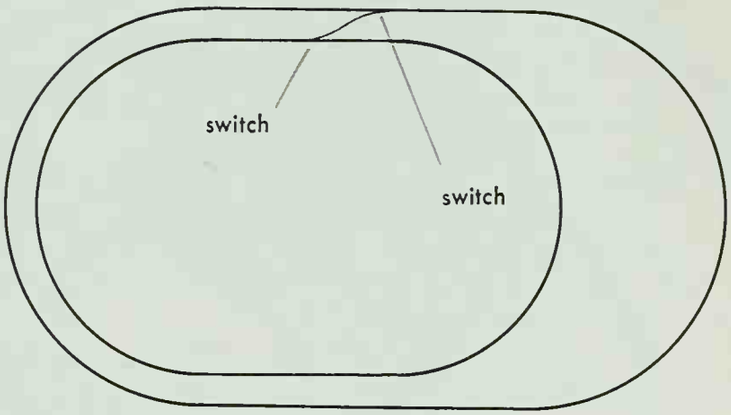


6. This is a variation of the figure-8 track plan. It requires a little more space than some of the other plans.

Crossings are available for different angles.



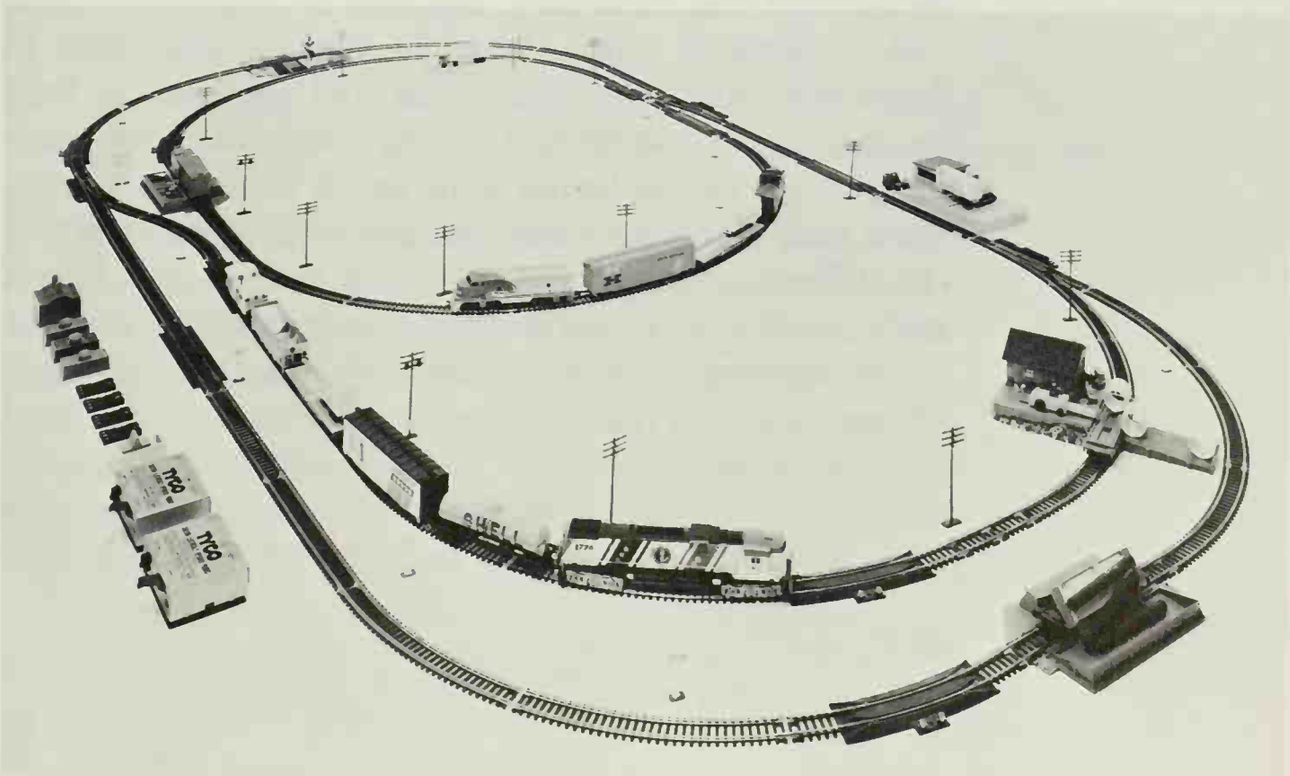
7. Now we begin to get a bit more complicated with lots of possibilities for all kinds of train movement.

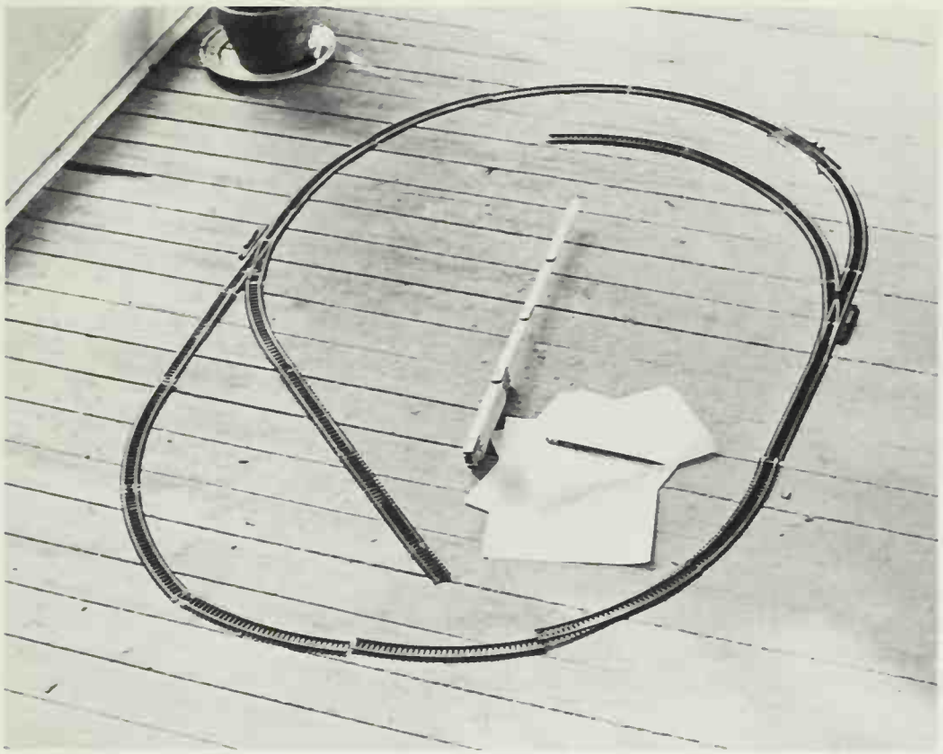


8. One loop within another. Two switches are needed to connect the two loops. Chapter 11 explains how two trains can be operated at the same time on this kind of plan.

The most commonly used track is called "sectional." It comes in straight or curved sections and is available in various lengths and in different degrees of curvature. It lends itself to a great variety of track layouts. But if you get involved in an unusual or complicated track plan, you may find that you will have to do some track cutting and careful fitting.

Below is a track arrangement that will accommodate two trains running at the same time. There are two power packs, four switches, and several commercial accessories. (This would be a rather elaborate layout to start with.)

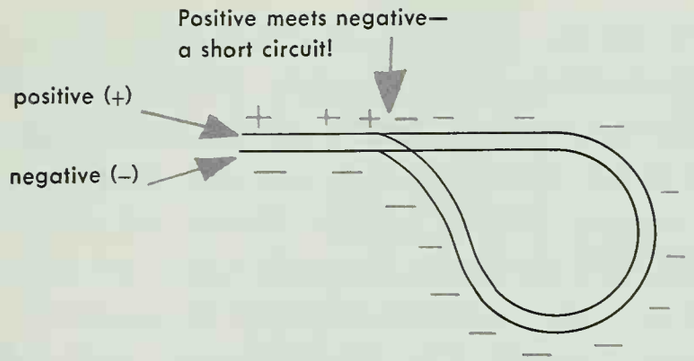




One possible track arrangement for the NP & H is being tried out here on the porch floor. This is basically a circle. But one switch and one section of straight track have been added to each side of the circle. And extra tracks have been run off from the switches.

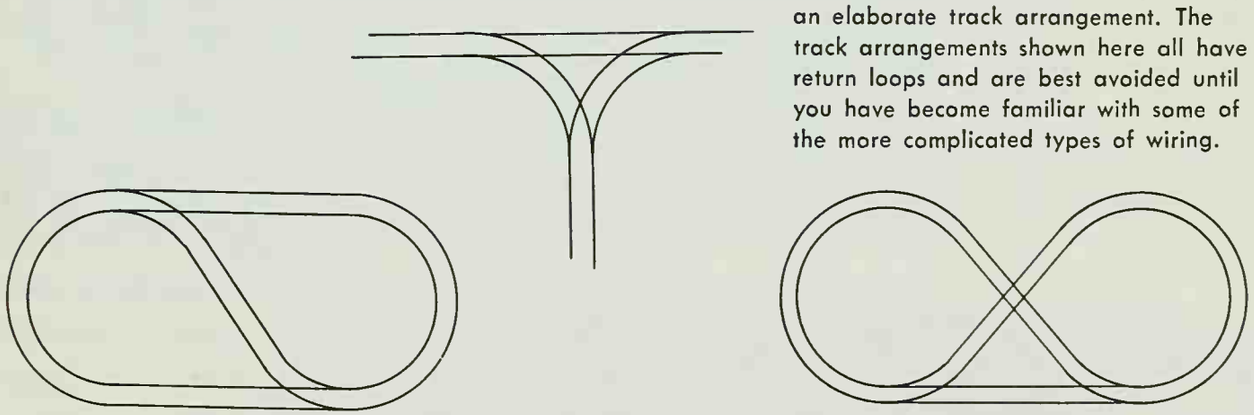
It is great fun to sit down with pencil and paper and plan track layouts. But unless you are really experienced, you'll often find that what looks good on paper won't work when it comes to actually putting tracks together. So the thing to do is to experiment with the actual track sections. If you have only the loop of track that came with your set of trains—14 or 16 sections—and want to figure out what additional track and switches to buy, try this: lay out as much track as you have. Then mark the position of the layout with pencil or string or tape. Then pick up all the track and use it to continue trying out different arrangements. (If you have a friend with trains, see if you can borrow some track from him or her.)

The drawings here show one particular kind of track arrangement to avoid if you want to keep your electrical connections simple. This is called a return loop. As the electric current goes along one rail, around the loop, and back, it ends up on the *other* rail. There is a short circuit.



This is a return loop. If you trace the path of the electric current marked negative(–), you will see that it goes around the loop on one rail and ends up on the *other*. It is like connecting one rail directly to the other electrically, or like short-circuiting the tracks by running a wire directly from one rail to the other.

This situation will occur whenever a train can travel in such a way that it goes around and ends up facing in the opposite direction. There are ways of solving this problem, using special switches and insulated gaps in the rails, but this sort of complication is best avoided until you have a good deal of experience with a more conventional layout.

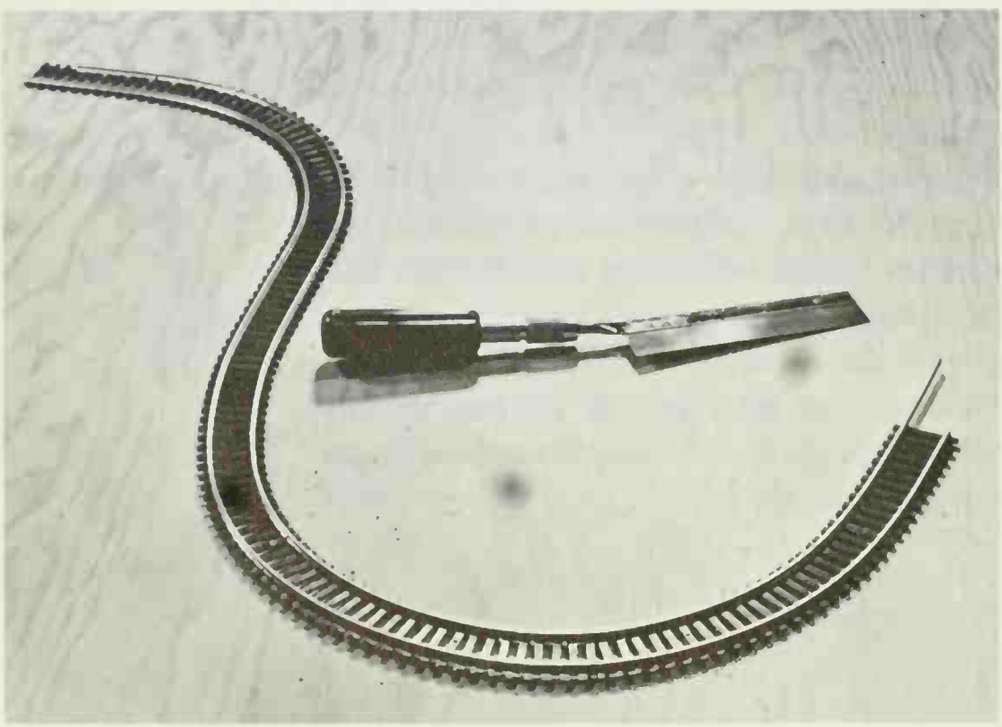


Sometimes a return loop is disguised by an elaborate track arrangement. The track arrangements shown here all have return loops and are best avoided until you have become familiar with some of the more complicated types of wiring.

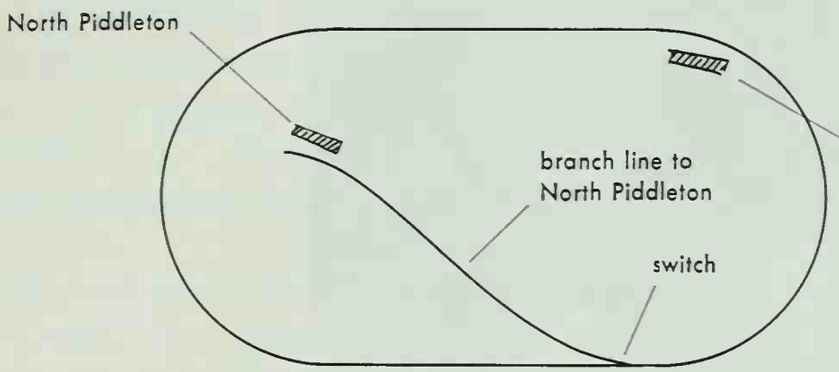
The curved track sections that come with most HO-gauge train sets are called 18-inch radius sections. This means that the section of track will fit on a circle that has an 18-inch radius. Eight sections of this kind of track can be fitted together to make a circle with a diameter of 36 inches. (O-gauge trains, even though they are larger, run on sharper curves. An N-gauge circle of track will fit within about a 21- by 21-inch space.)

HO track sections are available in other radii besides 18-inch. Twenty-two-inch radius is quite common and is used on large railroads where gentle curves look better, and where there is enough room. You can also get curved track sections with a 15-inch radius. These are useful where space is limited. However, it would make too tight a curve for a large, eight- or more wheeled locomotive to get around without trouble. The wheels would bind and derail. Fifteen-inch-radius curved tracks are what I used when, at a later date, I added an inner loop to the NP & H. Model-train stores also have 36-inch-long sections of flexible track. These will bend to any curve and are very useful. After you bend this kind of track, however, you will find that one rail is longer than the other, so you will have to trim off any excess with a hacksaw or a special, thin-bladed saw called a "razor saw." This is an inexpensive but very useful tool for all kinds of model making.

Standard lengths of straight and curved tracks are all you need for most ovals with a few simple sidings. But when things get crowded and there is a lot of track to fit



This is a three-foot section of flexible track. Notice how one rail has become extended because of the bending. With a minimum of fuss, you can cut off the rail with a razor saw, such as the one shown. (When you are cutting a special size of track in this way, you have to make another small cut to free the rail from the tie. This allows the connector to slide into place.)



Here is the track plan for the beginnings of the NP & H. It is quite simple with only one switch and a short branch line.

Happenstance (The stations were often shifted about.)

into a limited space, you will sometimes need tracks of odd lengths. You can buy assortments of short sizes: ¾-inch, 1-inch, 1¼-inch, 2-inch, 2½-inch lengths. These come in very handy. You can also cut up track to any special size you want.

The track plan I finally chose for the NP & H is a simple loop with one switch and a siding. A siding usually runs alongside the main line for a short distance and allows room for a slow train to get off to the side while an express goes by. With only one train in operation I would not have this problem. So this extra length of track could be considered a branch line—it branches off the main line. I decided it would go to North Piddleton.

There is another kind of short line that comes off a main line. It goes to a factory or some place where freight is to be picked up. This is usually called a spur line, or occasionally, an industrial siding.

Once the track plan was decided on, I bought the extra pieces of track I was going to need and a switch. I also bought a full-size sheet of plywood and cut it down to the size I wanted. (Most lumberyards will cut plywood to the size you want for a slight charge.)

At the lumberyard the plywood on which the NP & H will be built is loaded on to my car.

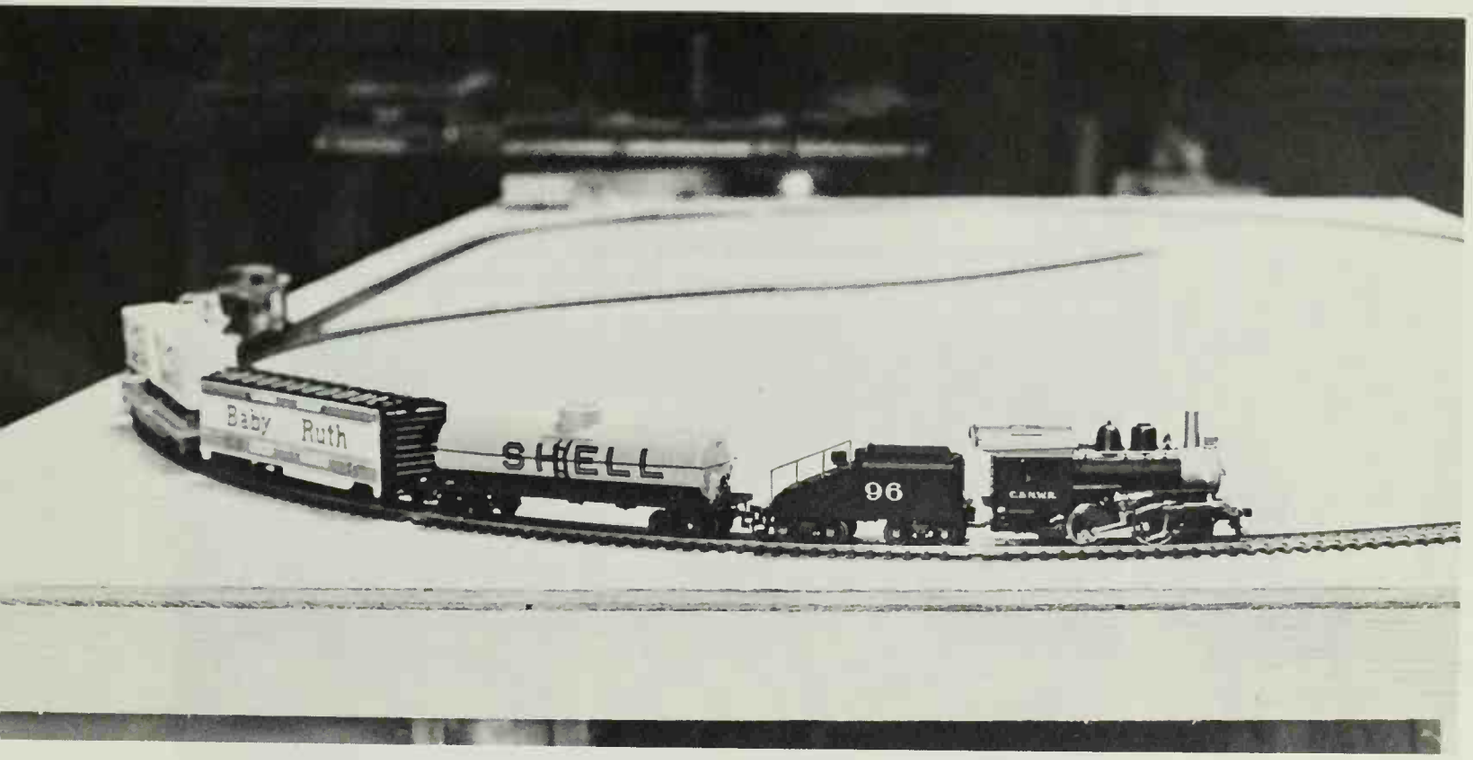
There are many other kinds of construction board, beside plywood, upon which track can be mounted. They include paneling, chipboard, pressboard, such as Celotex, and so forth. As long as the board isn't so hard that a nail can't be hammered in, it can be used. Some model-train engineers prefer a soft material, like Celotex, because it absorbs a lot of the noises that a train makes as it travels over the track. But plywood is what most people use.

There are various grades of plywood. The cheapest is called underlayment. It looks very rough and splintery, but track can be laid out on it because the surface of the wood will eventually be covered anyhow. It is so rough, though, that it is unpleasant to work with. The next grade of plywood is called CDX and is used for sheathing or covering the outsides of houses, under the shingles or siding. This will have some gaps and knotholes, but isn't nearly as rough as the cheapest grade.

The next step up is plywood, good-one-side. This will cost at least twice as much as the cheapest, but has one side that is perfectly smooth and even. The underside will have a few imperfections. I chose to use this kind of plywood because I planned to take photographs as I worked and it would look better. And besides it is much nicer to work with.

Plywood comes in various thicknesses, from ¼ inch up to ¾ inch. The thicker the plywood, the higher the price, of course. And also the greater the weight. One-fourth inch is too thin; ¾ inch too heavy. One-half inch or ⅝ inch are the thicknesses used most often. I decided to use ⅝ inch plywood because I expected the board would get a good deal of handling and shifting about.

Just to check everything out, the tracks were temporarily assembled on the plywood when I got home, and the trains had their first trial run—a historic moment!

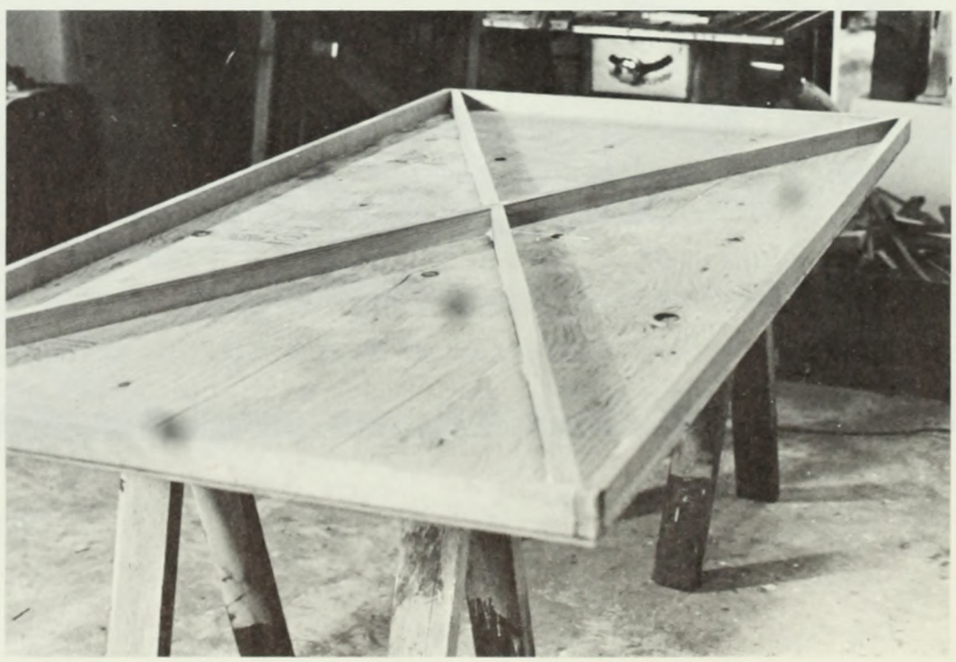


7. Putting It All Together

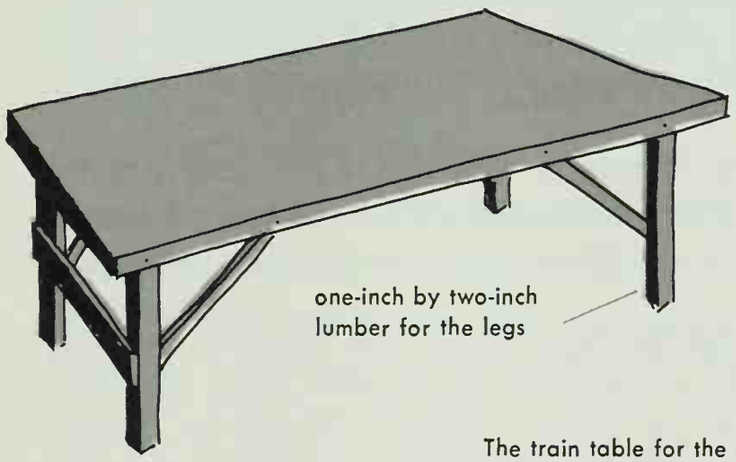
Making the Train Table

Even fairly thick plywood has a tendency to warp or wobble if not supported. In order to prevent this, a frame of wood strips can be attached to the underneath side. This framing, or "cradling" as carpenters call it, is not absolutely essential. But it does help to make a rigid surface, and it is definitely needed if you are going to add legs to your board.

The underneath supporting structure for a table is shown here. The X-shaped cross bracing is not very important, but it will give the table a little extra rigidity.

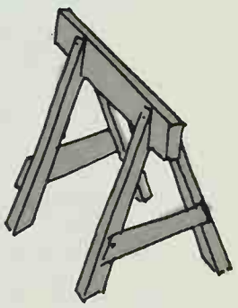


When the trains are on a very low table, or on the floor, you will always have a bird's-eye view of the action. This won't be as realistic or dramatic as a more level view. It is a matter of personal taste, but most people think model railroads look best when placed about two feet below eye level. That means that if you are going to be seated on a chair as you work your trains, the table should be about 26 to 30 inches high.

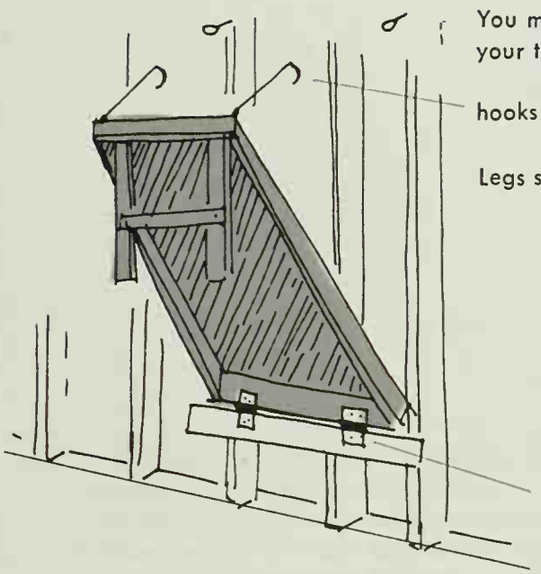


one-inch by two-inch lumber for the legs

If possible, do all fastening with nuts and bolts rather than nails. It is a little more work, but the table will be stronger and can be taken apart easily if that is ever necessary.



The train table for the NP & H is supported by "horses." These are wooden supports used by carpenters that can easily be moved about.

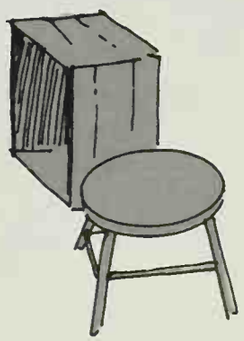


You might be able to hinge your table against a wall.

hooks

Legs swing down.

hinges



A train table can be supported by several sturdy wood boxes.

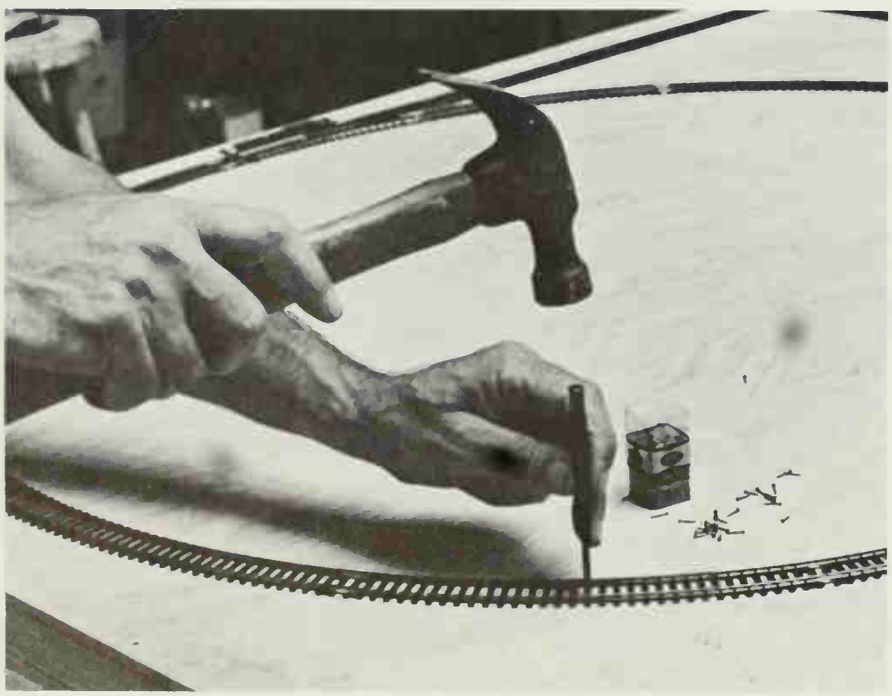
(An old Ping-Pong table will make a fine train table.)

Laying Track

Give your train table a coat of paint before laying the track. A gray-brown or gray-green—any earth color—will look well. Even though the wood will eventually be covered with roads, grass, and buildings, the paint will keep any uncovered spots or corners from showing as bare wood. If you use a fast-drying, water-based paint, you won't be held up for long waiting for the paint to dry. (If you can't find any suitable paint or if you prefer the look of the plain wood, you can skip this step without any great harm being done.)

The pieces of track must be attached to the table in some way. Otherwise they would shift about and work loose as the train passed along. There are several ways of doing it.

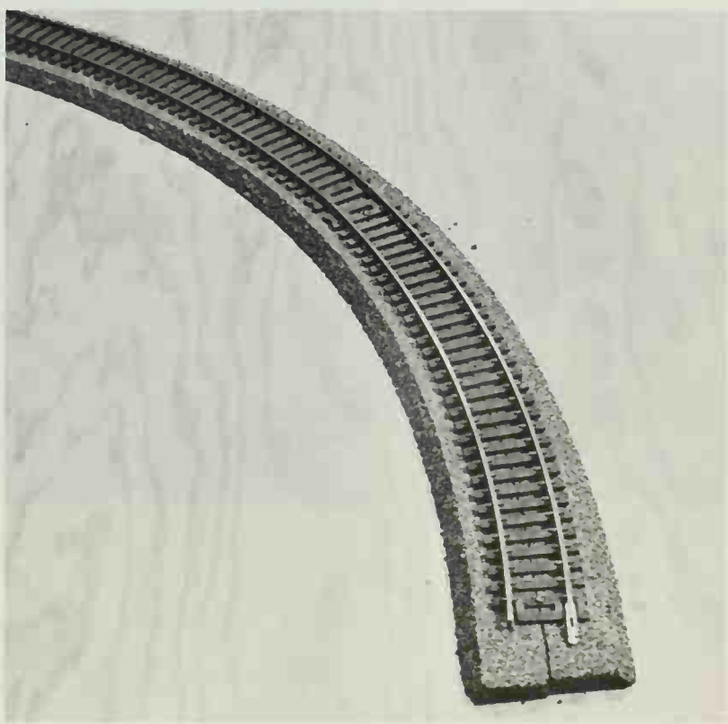
Nails. This is the simplest way. You'll find that in every full section of HO track there are at least three ties that have small holes for nails. O-gauge track has similar holes. However, small screws, rather than nails, are preferred for O gauge. A short thin brad will do a good holding job on HO track. Or you can buy the special nails made



A section of track being nailed down to the plywood. In order to avoid the possibility of damaging the rails with the hammer, the nail is driven partway in, and then a nail set is used.

for this purpose from your train store. When your sections of track are laid out exactly the way you want them, you can proceed with the nailing. Two or three nails in each section will hold it securely in place. You'll have to hammer carefully because plywood is hard and the nails will bend easily. Use a nail set or a piece of metal over the nail head after the nails are partway in. Otherwise the hammer might hit the rails and damage them. Don't drive the nails down hard, all the way. This would bend the plastic ties out of shape, and also make it difficult to pull up the nails if you ever want to make changes. (And everybody does make changes, eventually.)

On cork roadbed. This is another way to fasten down track. Special flexible strips of cork or similar material are available in any train store. It is a neat and good-looking way to attach the track. The cork has the appearance of a real roadbed, and also serves to deaden the noise of the trains. When it comes to switches or crossings, you have to do a little careful fitting of the cork strips, but many people think it is worth the extra trouble. The cork

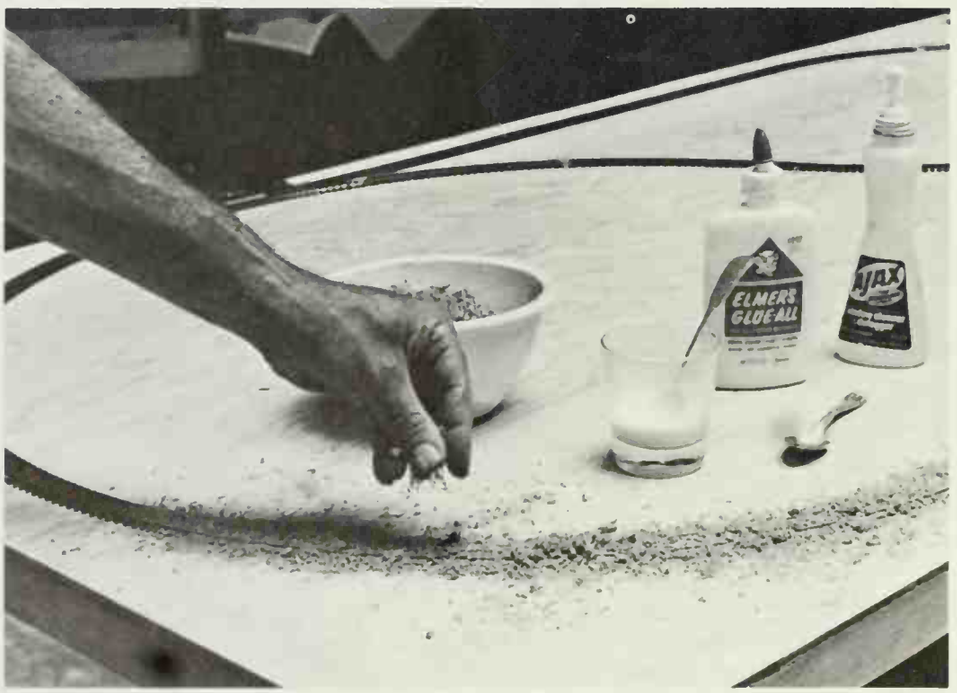


Most cork roadbed is sold in 36-inch lengths which are sliced down the middle. Separate the two halves and position them as shown, so that the beveled edges are on the outside.

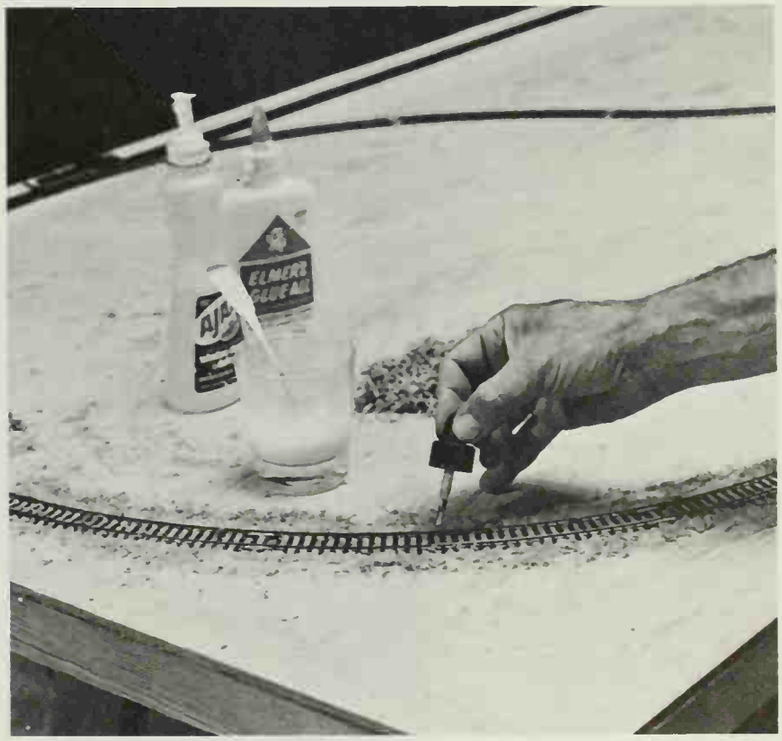
is actually a cushion under the track. The cork is held in place with nails—and then the pieces of track are nailed through the cork and into the wood underneath.

Glue. A mixture of glue and ballast will hold HO track securely in place—and also look very nice. Ballast on a real railroad is heavy gravel. It serves to support the ties, cushion the weight of the train, and also keep rain from puddling around the rails. You can buy model-train ballast. It looks a little like sand, though the color is different and the size of the grains more uniform. Actual sand is too dusty to work well as ballast. Another material often used for ballast is sawdust. The NP & H uses sawdust ballast in some places—and store-bought gravel ballast elsewhere. This is how it is used.

The track is temporarily held in place with the nails. (They are not hammered all the way in, so that they can be easily removed after the glued ballast is dry.) In this photograph the ballast, which is sawdust, is being sprinkled over the tracks.



Now the excess ballast has been brushed away, and what remains is being dampened with water dripped from an oil can. (A few drops of detergent should be added to the water so that it will spread.) Another way to dampen the ballast is with a sprayer of some sort.



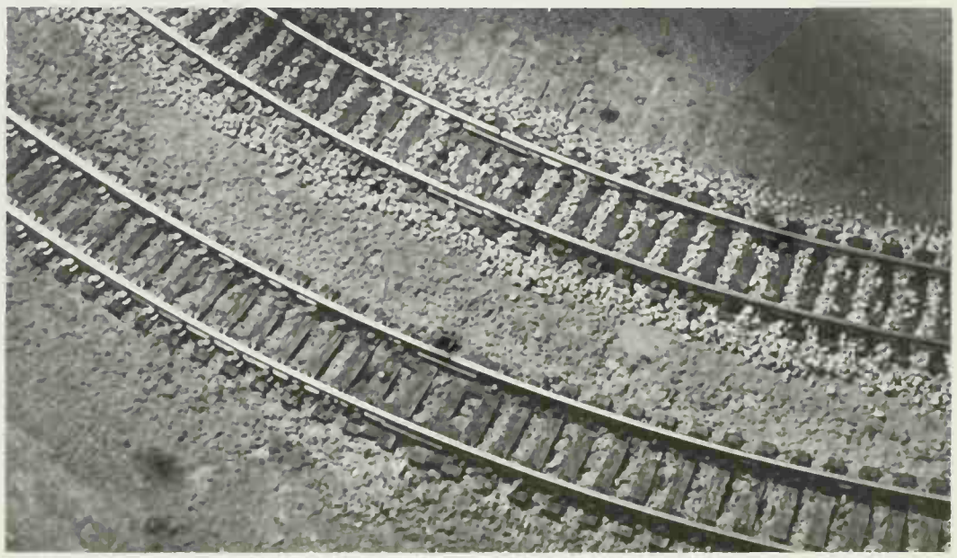
A mixture of white glue and water is being applied with an eyedropper. About one-part glue to three-parts water will hold the ballast securely in place. Allow a day for the glue to dry. One advantage of using glue and ballast instead of nails is that the tracks will be easier to remove if you want to make changes in your track plan.

If you decide to attach your tracks with either gravel or sawdust ballast, you should first make a little test to be sure your materials will do the job properly. Form your ballast into a little mound, dampen it, then drop on your glue and water mixture. Let it dry for a day and examine the results. If the mound is loose and crumbly, try again, using more glue and water, or use a higher proportion of glue to water.

If you know anyone with a woodworking shop, you should be able to get all the sawdust you want. You may also be able to get some from a lumberyard. They usually have odd piles lying about where they cut lumber to size. Ask if you can scoop up a bagful.

Most sawdust will be light in color. To darken it, put it in a bowl in a solution of black or brown fabric dye. Or mix it in with some cold coffee or tea. Then spread it out on a newspaper to dry before using it.

Here are two sections of completed track: the ballast has dried, and the loose bits have been brushed or vacuumed away. On the upper track, the ballast is gravel; on the lower, sawdust.

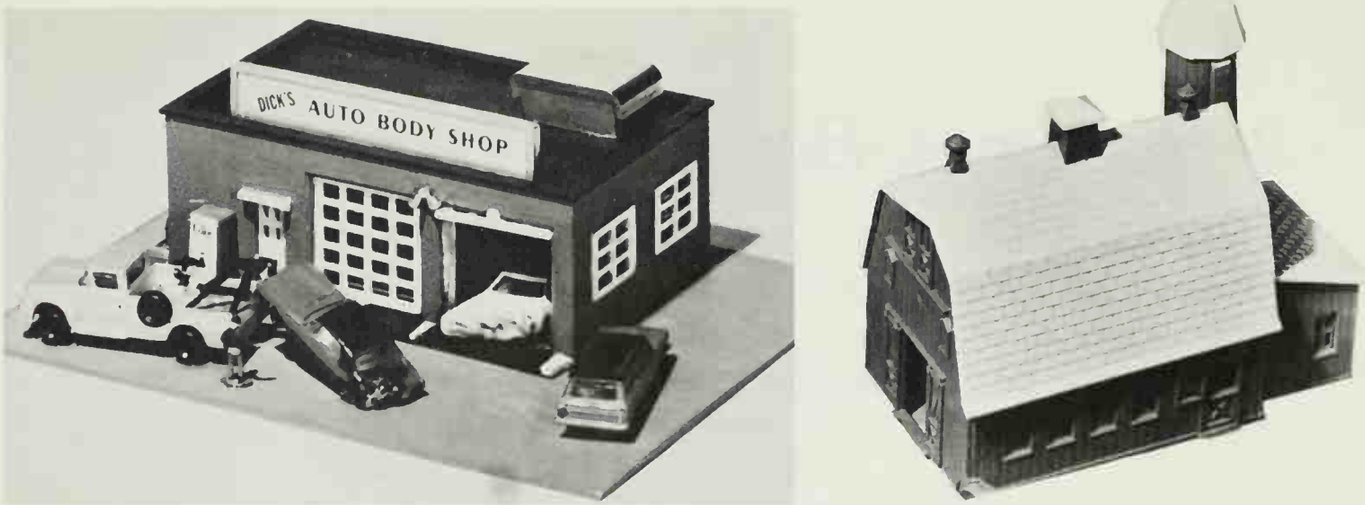


8. Buildings, Bridges, and Such

A model railroad with only track, switches, and trains is not much of a railroad. If you want a realistic-looking setting and want your trains to look as if they were really going somewhere—past towns, over rivers, through fields, doing a job—then you need stations, factories, mines, cranes, towns, barns, and so on.

The various structures described here can in many cases be bought as wood or plastic kits. The kits are complete with plans, illustrations, and all necessary parts. Some structures are quickly fitted together. Others take a good deal of careful work. The expense can become considerable if you are going to do a lot of building. Prices vary from two or three dollars for a small plastic kit to anywhere up to thirty or forty for large and complex kits using many different materials. A lot of people like to use these kits. They can be sure of accurate scale and correct detail.

Other people, like the president and chief stockholder of the NP & H, prefer to build their own idea of what a bridge or derrick or barn should be. It is great fun to plan and construct a good-looking building from just a few odd scraps of wood and cardboard. Never mind if all the rivets aren't there on the bridge, or if the window panes aren't in



Some plastic kits come with many small related parts. The garage on the left even has a Coke machine. On the right is a barn, which is certainly necessary when a train is traveling through farm country.

place, or if the proportions aren't exactly correct. And besides, kits are limited to a few ordinary things. You aren't likely to find a kit that will let you make a house like the one you live in, or a particular little bridge that you might have seen somewhere and want to have on your railroad.

A grouping of many buildings, or the tanks and towers in a train yard, may seem like a big undertaking. The job is only difficult, however, if you try to do it all at once, in a hurry. Like all construction on and improvements of a model-railroad layout, it should be done bit by bit, a little at a time.

Buildings

Cardboard or balsa wood can be used to make model-railroad buildings. If you use cardboard, it should be fairly heavy and rigid. Thin, floppy cardboard won't hold its shape well, and will be too fragile to handle. The kind of cardboard that comes in a laundered shirt is good. So is the kind that is used to back up a drawing pad. If you use balsa wood, it should be at least $\frac{1}{16}$ inch thick.

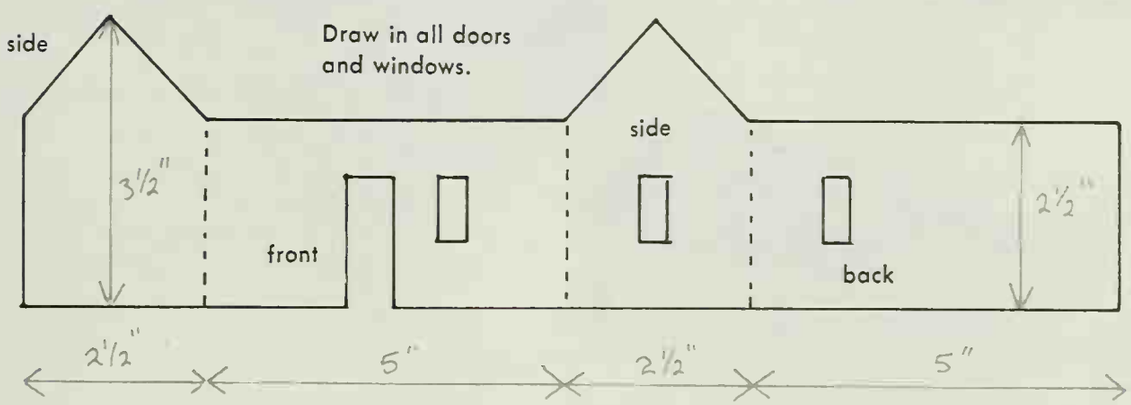
The secret of getting strong, good-looking buildings is not in the cutting and assembling, but in the preliminary measuring and ruling. If you take your time and measure carefully and accurately, so that the sides are parallel and all corners square, you can't go wrong. The drawing shows how you would measure and rule the lines for a simple cardboard or balsa-wood railroad station. The dimensions shown are for HO scale. Double them for O gauge. Halve them for N gauge.

Some cardboard buildings have a pleasant, gray, weathered look if left unpainted, and if the cardboard has a nice color and texture. If you decide to use paint, almost any kind will do, as long as it isn't shiny. Avoid enamels and high-gloss paints.

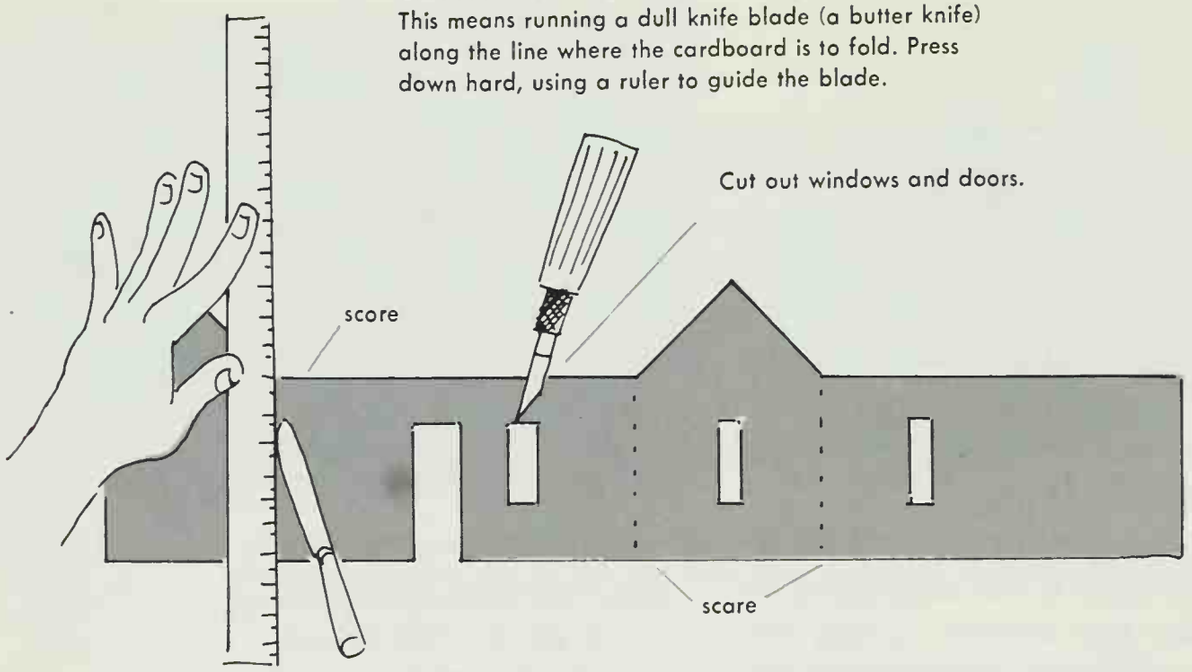
These dimensions are only suggestions (for HO scale). Be your own architect and make any changes you want.

(To draw a parallel line, make two marks the same distance in from a straight edge of your cardboard. With a ruler, draw a line connecting the marks, and you will have a line parallel to the edge. This method can be used whenever you want to draw one line parallel to an edge, or parallel to another line.)

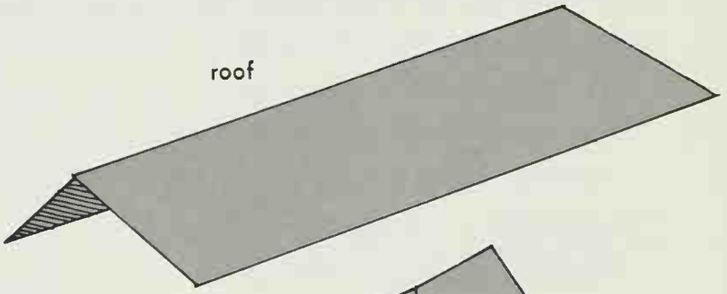
Measure and rule all lines with the greatest care.



Cardboard must be "scored" in order to bend it neatly. This means running a dull knife blade (a butter knife) along the line where the cardboard is to fold. Press down hard, using a ruler to guide the blade.

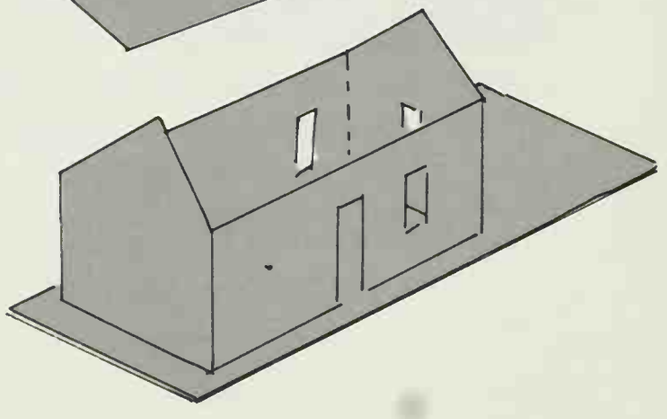


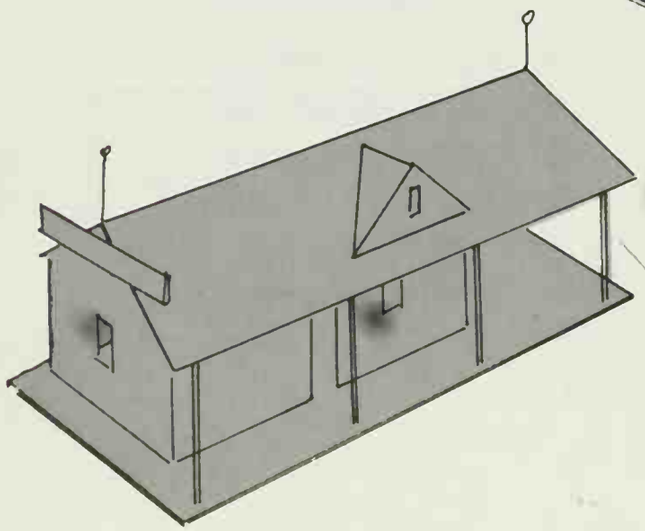
A good pair of scissors will work if the cardboard is lightweight. For balsa wood or heavy cardboard, you need a knife with a very sharp, pointed blade. Exacto modelmaker's knives with replaceable blades work well.



Fold the walls into place and glue the open corner together. Any fast-drying white glue or modelmaker's cement will do.

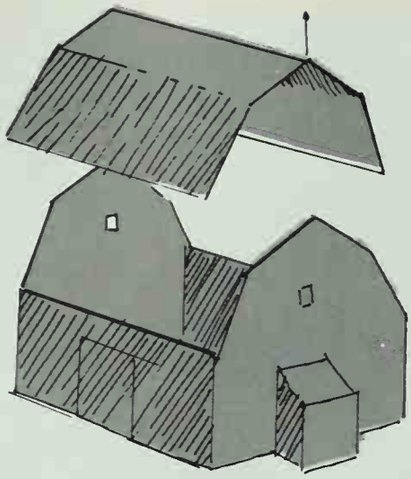
Attach the walls to a cardboard base for additional strength.





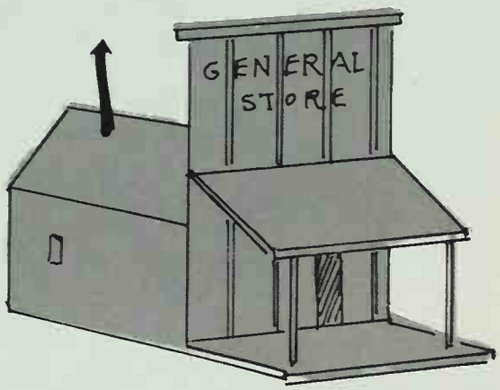
A dormer window set into the roof will dress up the station (or any other building) considerably. This sort of addition requires some careful cutting at odd angles, but it is worth the trouble.

Thin dowels or sticks will support the overhang.

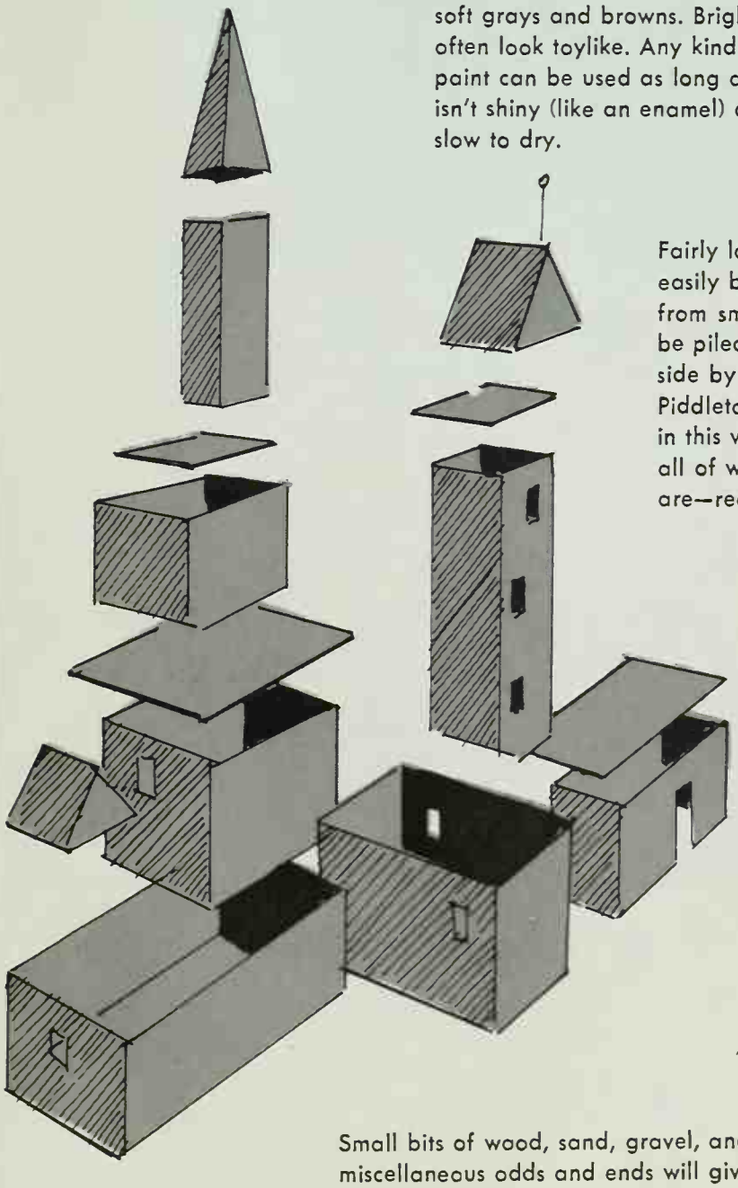


Many barns have a roof like this.

Some model railroaders like to create an old-fashioned look. This is particularly appropriate if your trains are not modern types.

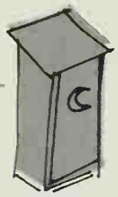


If you paint your buildings, use soft grays and browns. Bright colors often look toylike. Any kind of paint can be used as long as it isn't shiny (like an enamel) or slow to dry.

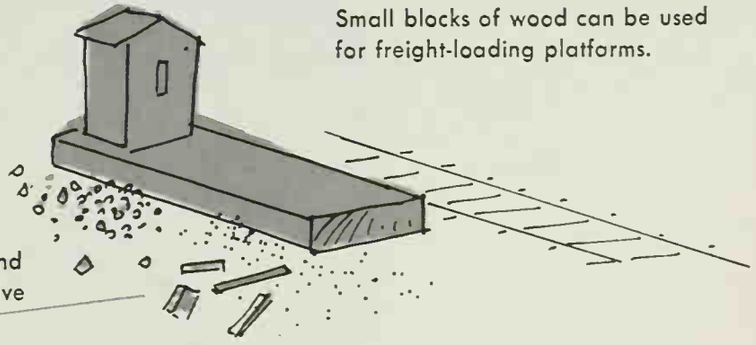


Fairly large and complex buildings can easily be constructed if they are assembled from small separate parts. The parts can be piled one on top of the other or placed side by side in many different ways. North Piddleton University, on page 67, was assembled in this way. Peaked roofs, towers, base units, all of which come apart, can be—and often are—rearranged as whim and fancy dictate.

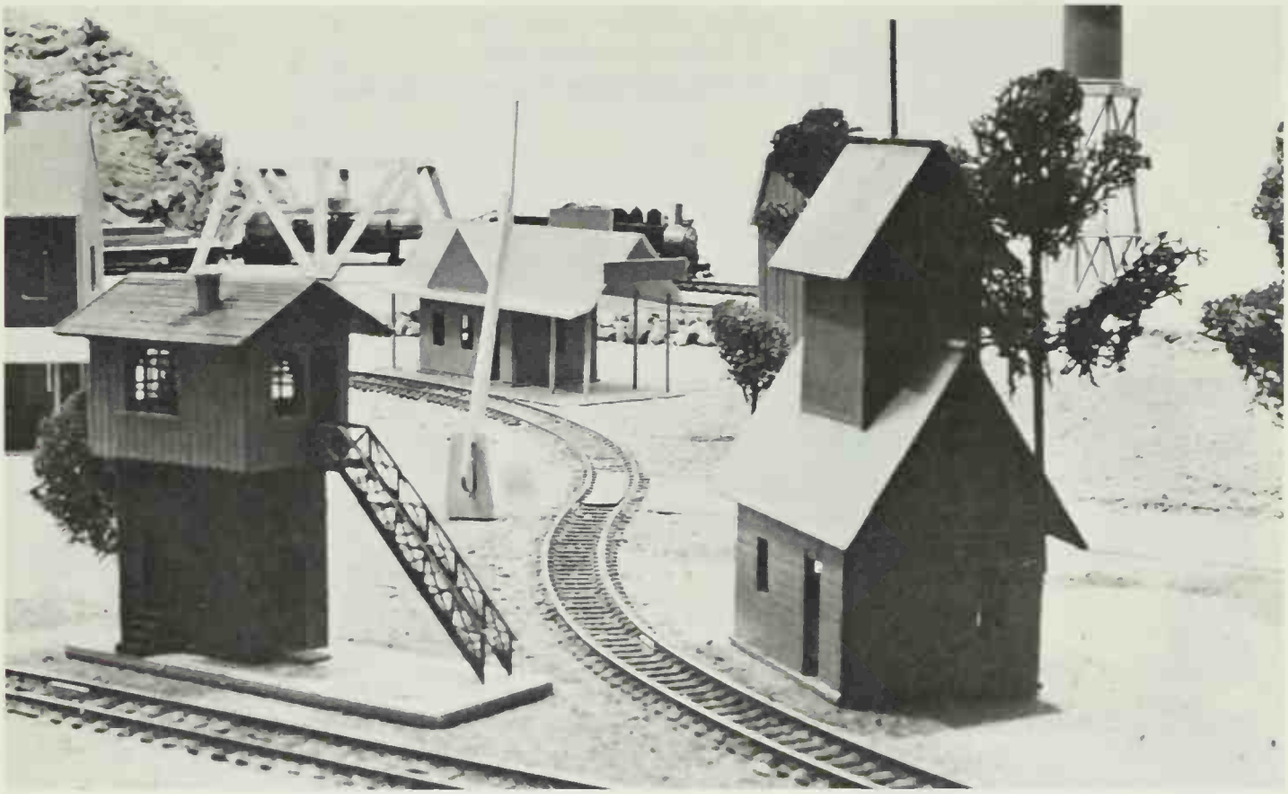
Little sheds and other additions make for realism.



Small blocks of wood can be used for freight-loading platforms.

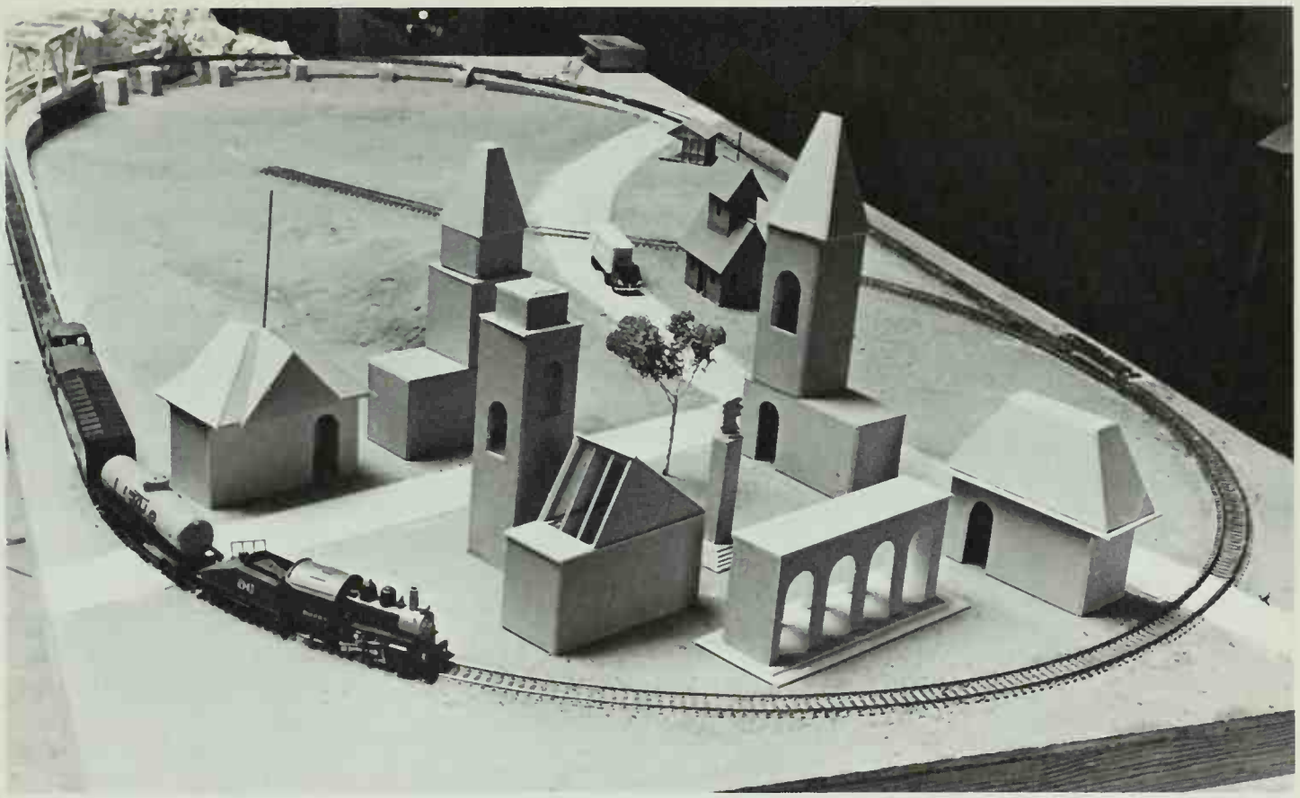


Small bits of wood, sand, gravel, and miscellaneous odds and ends will give your buildings a used look.



That's the North Piddleton station in the background. This photograph was taken after quite a few structures had been built and a good deal of landscaping completed. The signal tower on the left with the staircase was assembled from a commercial kit and is the only plastic, store-bought structure ever used on the NP & H.

The group of buildings below looks like the sort of thing you would see along the main street of some small town.



Here are several buildings of various proportions which have been placed together to form North Piddleton University! These buildings are all constructed in the same way as the railroad station. The only difference is in size and shape. When you make many small buildings and parts of buildings, like these, they can be shifted about and rearranged in any number of ways, into all sorts of combinations to make town squares, a museum courtyard, city streets, or whatever you choose. (If the NP & H landscape seems different between one photograph and another, it is because things were always being moved around to suit ever changing ideas and preferences.)

Bridges

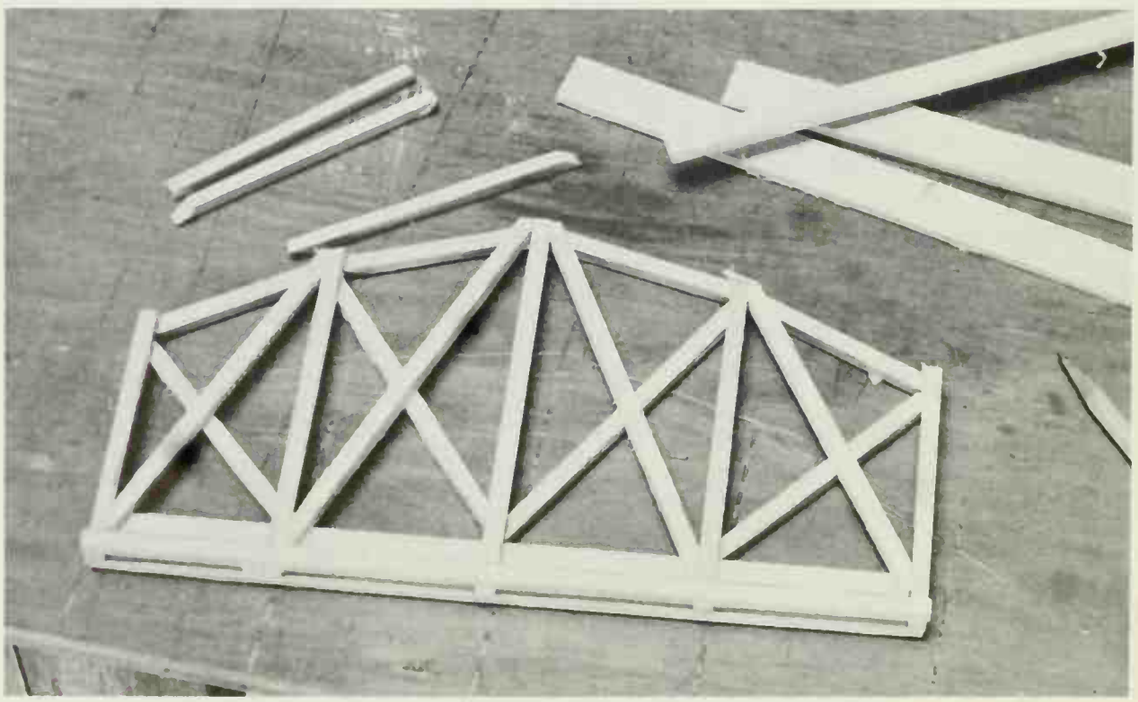
The bridges shown, or ones like them, can be built with strips of balsa wood. But you'll get much sturdier structures if you use a stronger wood such as pine. You probably won't find anything quite like these strips in a lumberyard. But if you know somebody with a woodworking shop, you might be able to persuade him to cut some up for you. Or else you'll have to find something similar. One

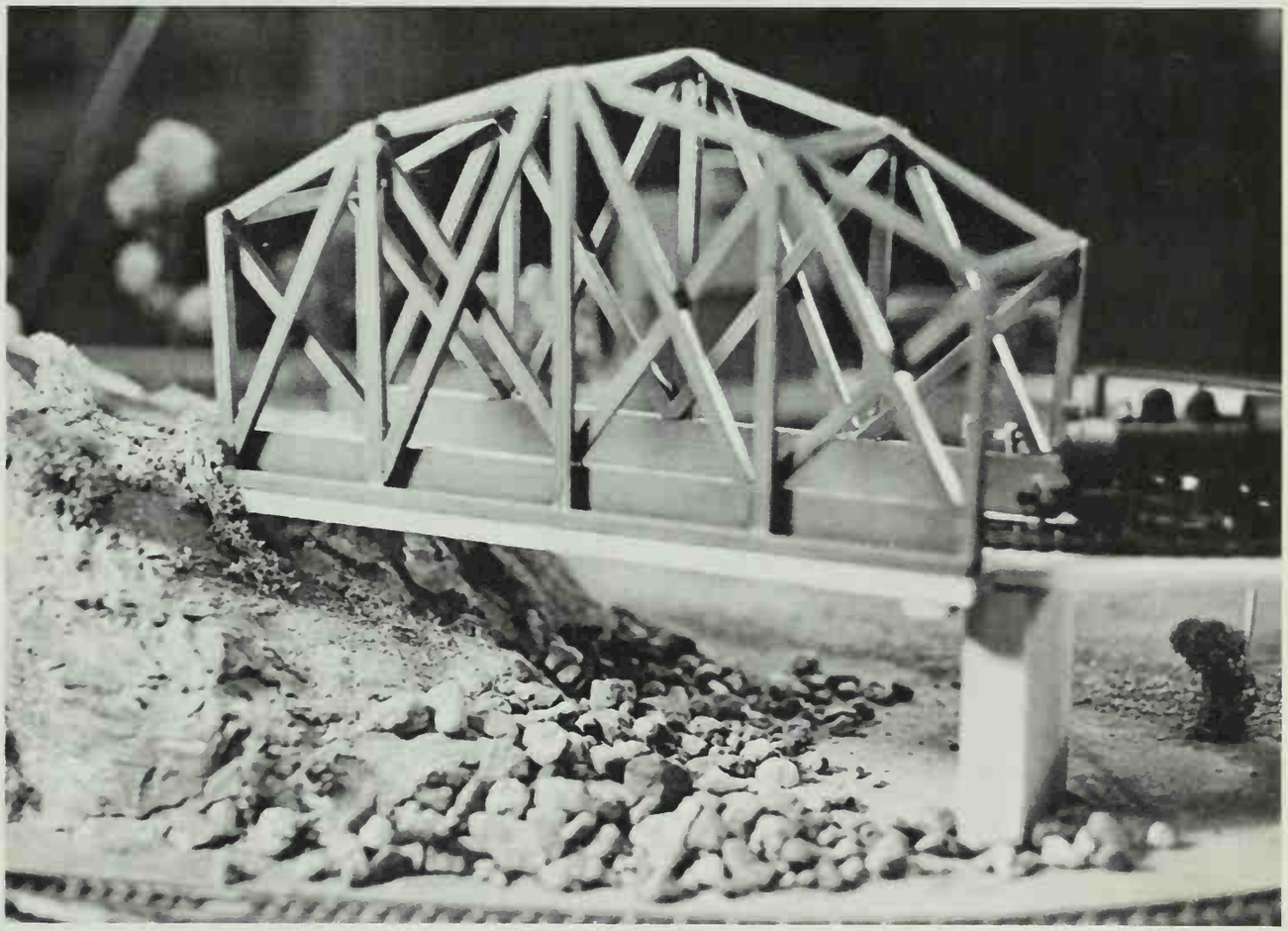
good substitute is Popsicle sticks. Tongue depressors are also good. You can buy these at any drugstore or get a handful from your doctor. However, tongue depressors are too wide. You will have to trim them carefully to the size you want with an X-acto or utility knife and a steel rule as a guide. Don't try to cut through the wood in one stroke. Use many light cuts, and watch your fingers!

You could also use thin wood dowels or rods. If you do use these, cut the ends flat where they are to be glued together so that there will be better contact and a stronger joint.

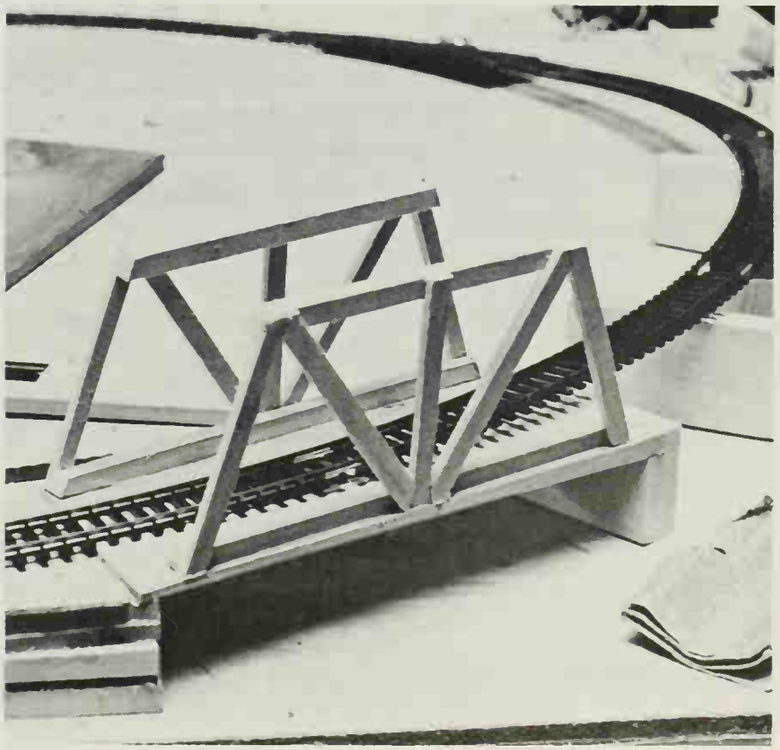
The bridges shown here are quite simplified, and not very large. If you want to build something more ambitious, all you have to do is to increase the number of girders as needed. If the span is more than 5 or 6 inches, however, you might have to support the center part with a column or pier of some sort.

The secret of easy bridge building is to make one side of the bridge at a time. If the sides are laid out flat on a table, it is easy to carefully cut and glue the pieces together without having to do any delicate balancing or holding in place while the glue dries.

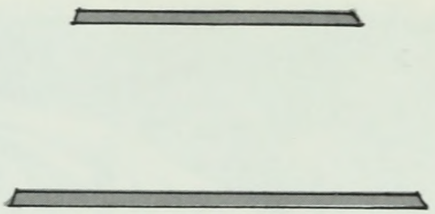




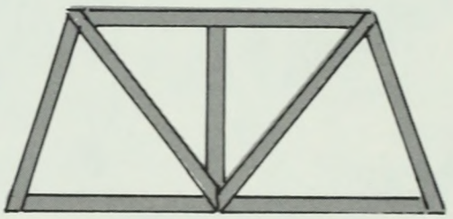
Here is the finished bridge, sanded smooth, painted, and set in place. It is a little more elaborate than the one shown below and makes an interesting and colorful addition to the NP & H railroad empire. On the simpler bridge, two sides have been completed and glued to a thin, supporting board. All that remains to be done is to cut and attach the three upper crosspieces that join the two sides. More detailed instructions follow on page 70.



1. Begin by cutting two pieces of wood for the upper and lower supports. Lay them on a flat surface.

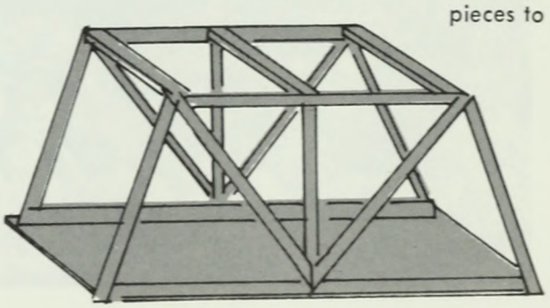


2. Cut and glue on the five side pieces. Take your time to trim the ends, so that everything will fit snugly.



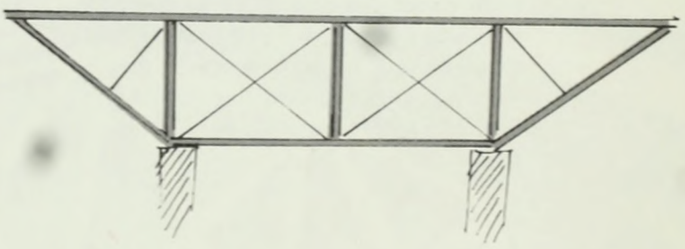
Use two or three cross-pieces to join the sides.

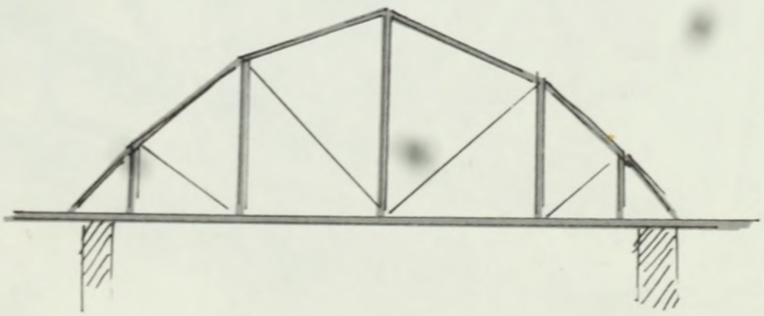
3. Glue both sides of the bridge onto a thin piece of board. If you can't find a suitable piece of wood, use heavy cardboard. (Don't use the corrugated kind.) If you do use cardboard, you may have to glue on stiffening pieces of wood to the underside.



No dimensions are given here because the size of the bridge you build will be determined by the area that must be spanned and also by the materials you have to work with.

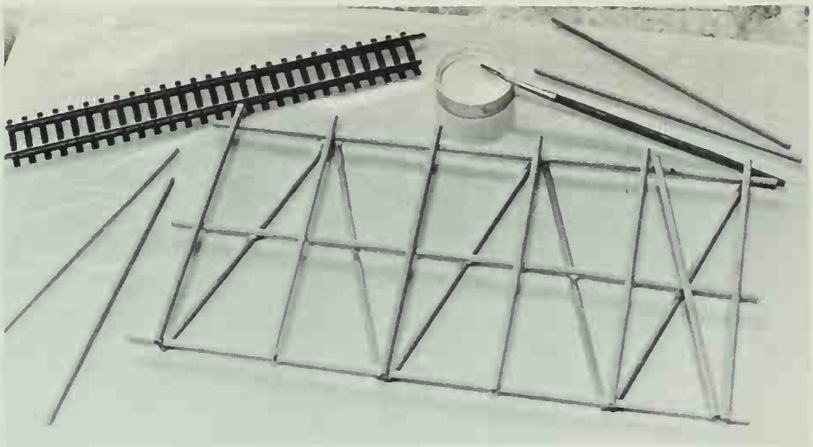
The wood strips used to build the bridges on the NP & H were approximately ¼ x ¼ inch square.

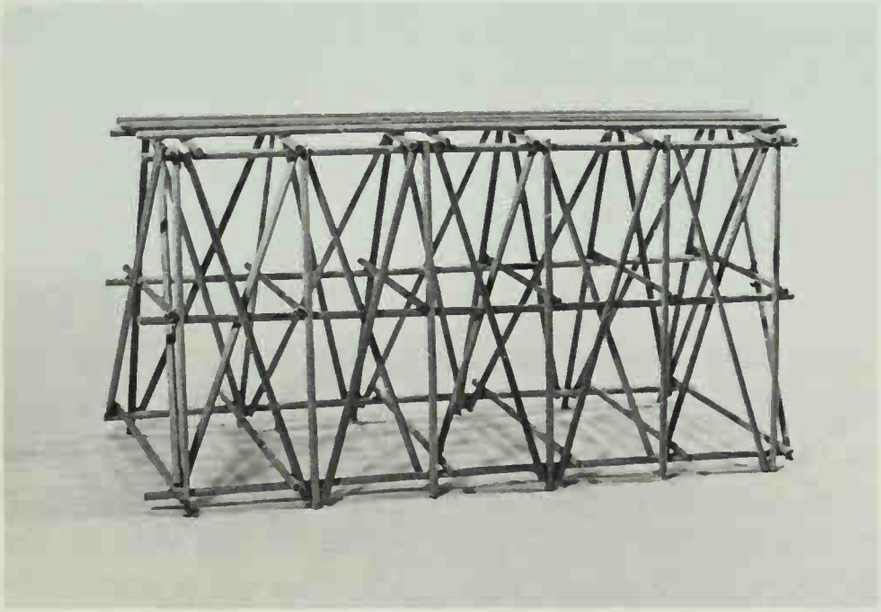




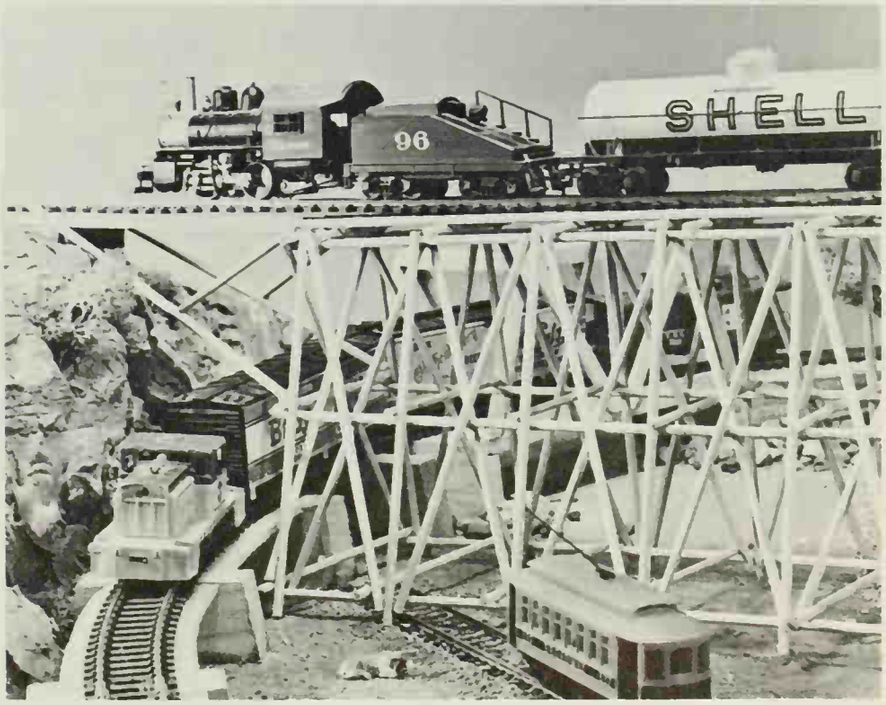
There are many different kinds of bridges in many styles, but quite a few of them can be built using the "one-side-at-a-time" method shown here.

A trestle is like a bridge and is used to support an elevated section of track. It isn't intended to span large spaces, such as wide rivers or canyons. The method of construction is the same as for a bridge—one side at a time. A great many thin sticks or dowels are needed, and some patience and care when the sides are joined.





As you can see, a finished trestle makes a lovely pattern of lines, and will always look well if neatly and carefully made.



Here's a finished trestle set in place. Even though a trestle may look thin and delicate, it will be quite strong, if well built, and it can support a considerable weight.

Up and Down

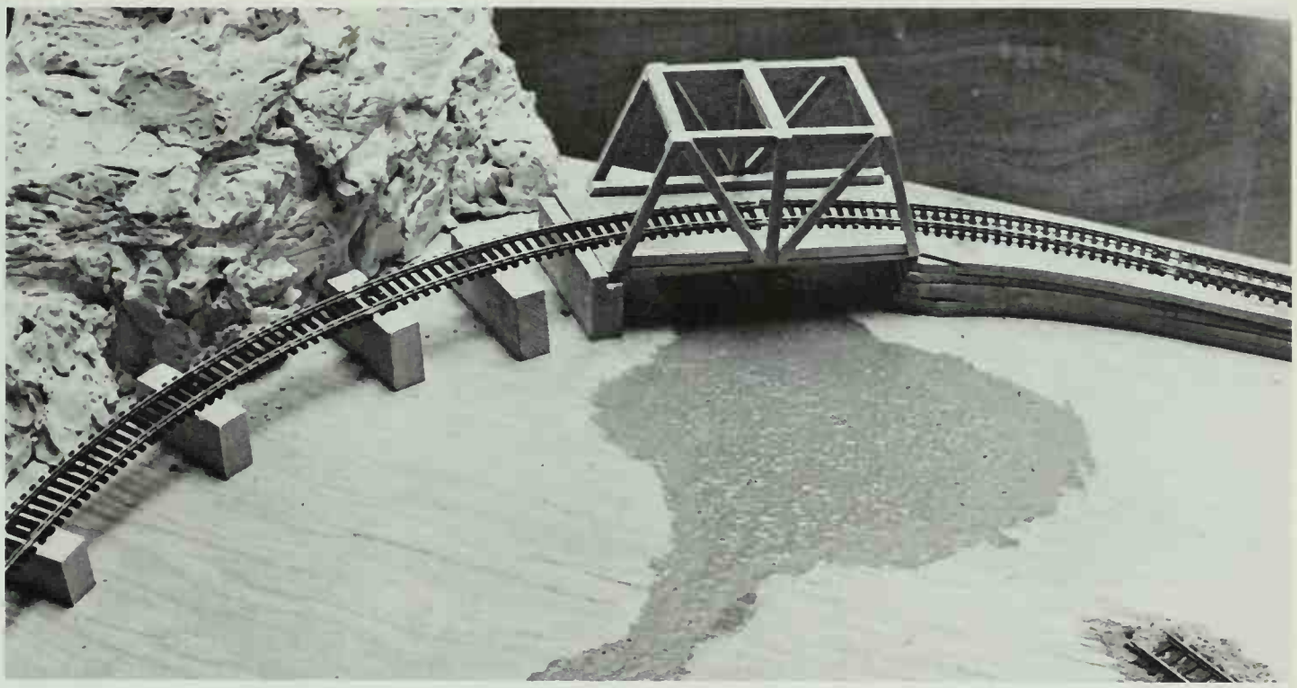
There isn't any point in building a bridge unless it crosses over something—a road, a river, another set of tracks. And if it is going to cross over something, that means it must be elevated somewhat. The tracks will have to rise up above the level of the plywood base.

The rise must be very gradual, however. A model locomotive cannot go up a steep incline—especially if it is pulling several cars. The maximum recommended grade is 4 percent. That means that the tracks can go up 4 inches for every 100 inches of trackage. Or they can go up 1 inch while traveling horizontally 25 inches.

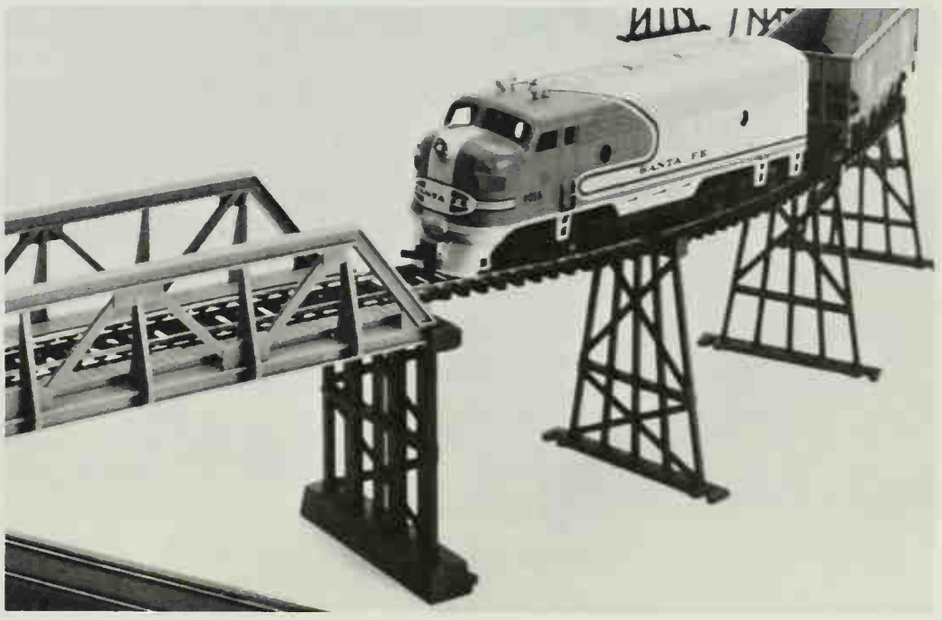
Before you begin to build a permanent incline, try out the grade. Gradually raise the tracks with temporary supports, such as blocks of wood or books. Then see if your train with a full load of cars can get up the grade without stalling or spinning its wheels.

The easiest way to build an incline for tracks is by means of a series of wood blocks gradually increasing in height. On the NP & H I used blocks on one side of the bridge and a ramp on the other side. The ramp was made from a few wood shingles. These were cut into 3-inch-wide strips, then piled up to form a gradually inclined ramp. A few drops of glue between the shingles kept them from shifting about.

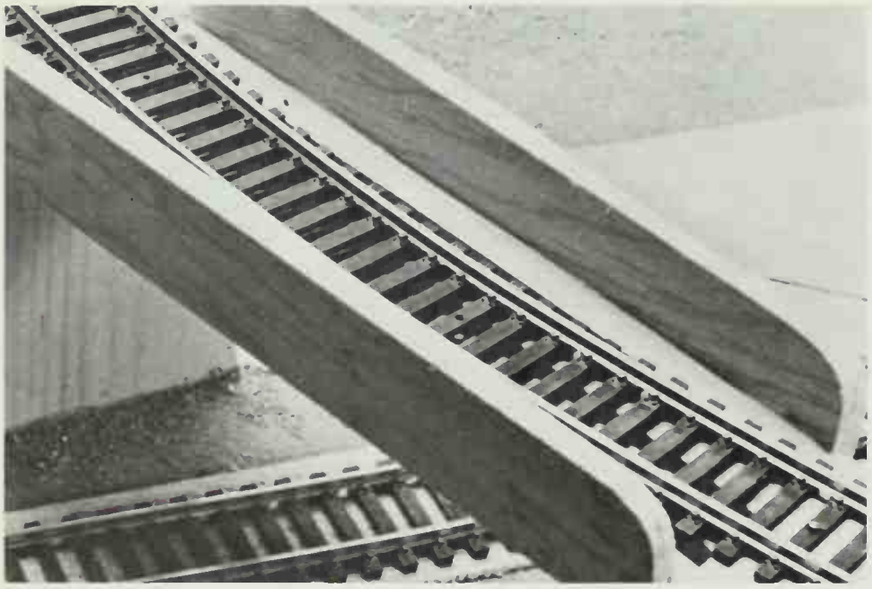
Some of the most interesting track plans involve the use of ramps, bridges, and tracks crossing over one another. Model trains look particularly nice going up and down and operating on different levels. However, an entire railroad running on trestles, ramps, and bridges would look rather odd. So what many model railroaders do is to con-



The tracks on the left were raised up on an incline to the level of the bridge by means of blocks of wood that gradually increased in height. On the right of the bridge, thin wood wedges and shingles were used to lower the tracks back down to tabletop level.



This plastic bridge and trestle come as part of a complete packaged train set.



This is a little corner of the NP & H where an elevated section of track passes over two other tracks. A low railing has been added to the strip of wood that supports the upper track to make a very simple kind of small bridge.

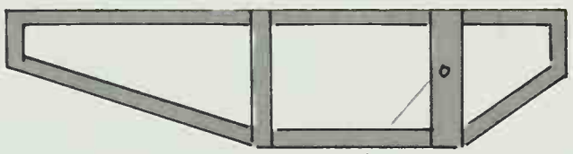
struct hilly or mountainous terrain. This sort of landscape building is something you might want to plan for when you get an urge to expand your layout. The next chapter explains how it is done.

Derricks

The derrick shown here actually works and is very handy for loading and unloading freight. If it is placed near a siding or alongside the track at a freight station, you can stop the train with a flatcar or gondola next to the derrick and handle lumber, coal, gravel, or whatever else you find to use as freight.

The derrick made for the NP & H was built of wood strips about 3/16 inch square. If you can't get something like this, you can use thin wood dowels, or you can piece together thin strips cut from Popsicle sticks or tongue depressors. Still another possibility is the stiff wire from coat hangers. Directions for building the derrick follow on page 76.

This derrick—the pride and joy of the NP & H freight crew—is used for the loading and unloading of all kinds of lumber and miscellaneous freight. It may look complicated at first glance, but it is not at all difficult to make.

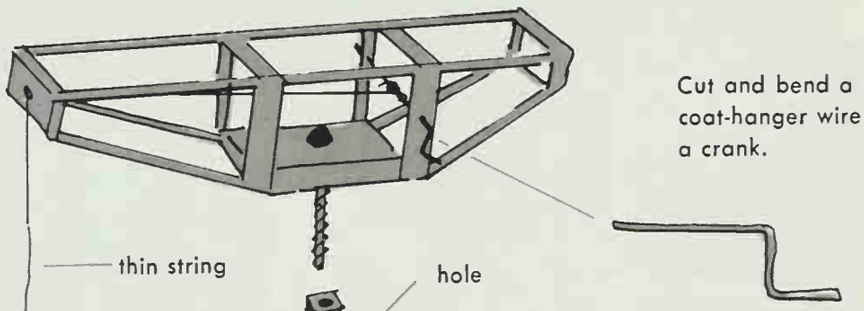


one side of the upper section

Each section is built the way a bridge is built—one side at a time, and then the sides are joined with crosspieces.

The derrick is made in two separate sections: A top section that turns and a lower section that is a sort of supporting tower.

Put a dab of glue on the end of the crank to keep it from slipping out.



Cut and bend a piece of coat-hanger wire to form a crank.

The upper section can swivel, because it is held in place by only a single nut and bolt.

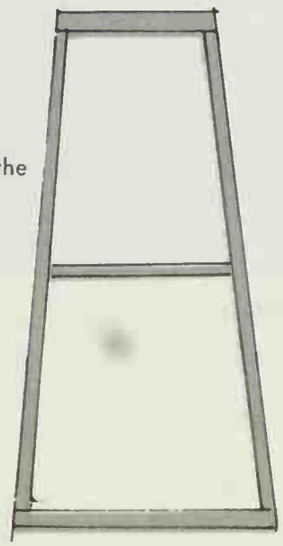
thin string

hole

You need a weight, such as a heavy nut or a few washers, to make the hook drop down when the crank is unwound.

hook formed from wire

Balsa wood is readily available in sizes that are convenient for bridge and derrick building—and can be used as a last resort. But it is not a strong wood intended for hard use. (If you ever eat in a Chinese restaurant, see if you can get some chopsticks. They are perfect for all sorts of construction!)



one side of the base section

Thin sticks can be used for additional bracing, if needed, or for the sake of appearance.

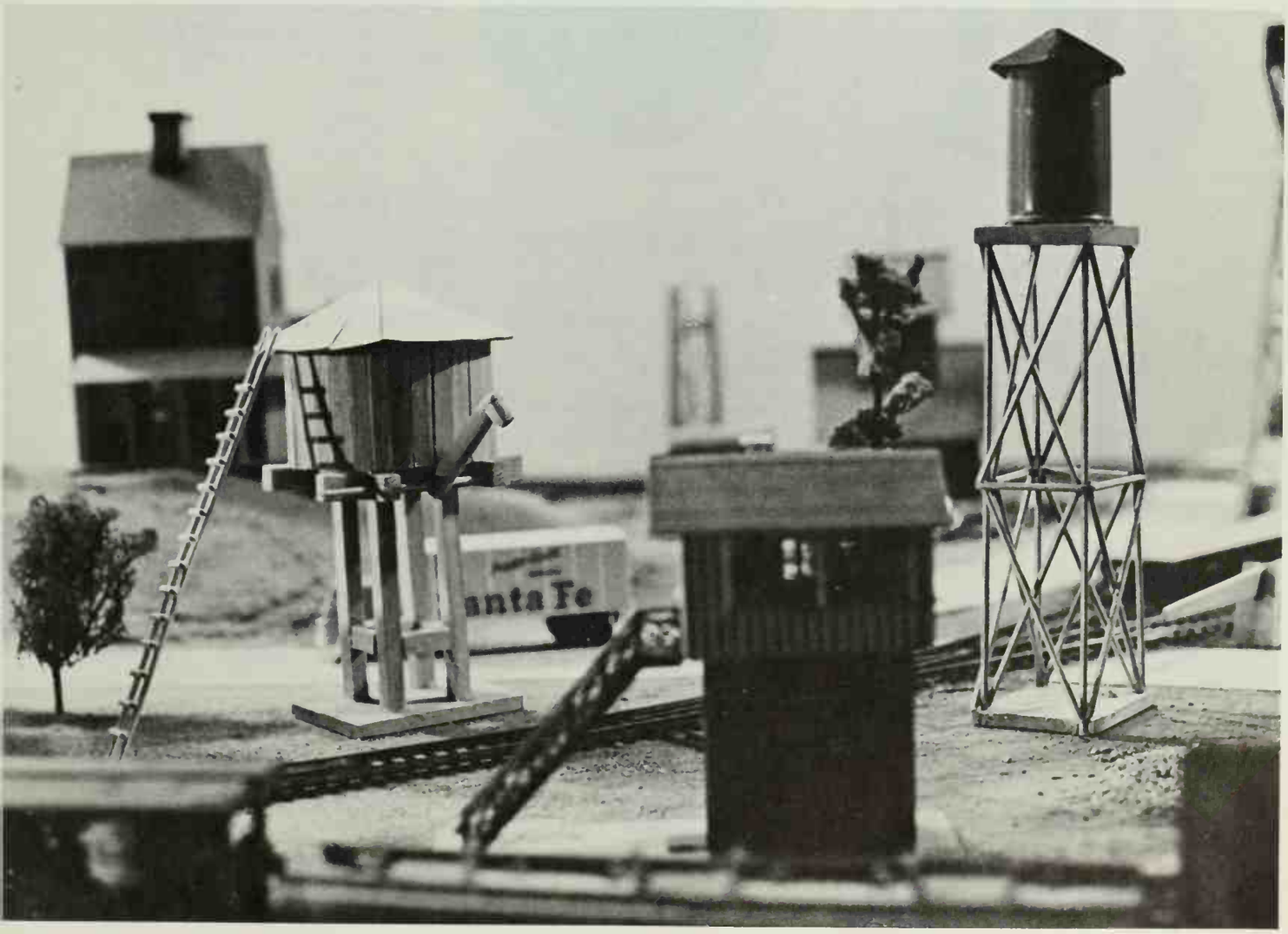
Use a thick block of wood at the bottom for stability.

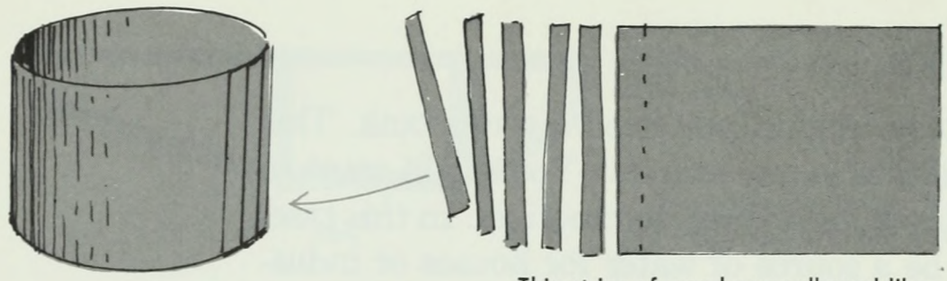
The base can be glued or screwed on to the train table to keep it from tipping over when a heavy load is being raised.

Water Tanks

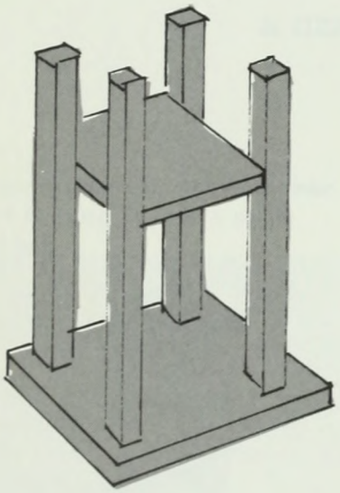
If you have a steam engine, you need a water tank. This is an elegant addition to any railroad. You might want to build one, even if you have diesel locomotives. In this case, the tank would be a source of water for houses or industries. The NP & H water tank was made from thin strips of wood glued around the outside of a plastic cover from a can of spray paint. Any similar small round shape could be used—part of a paper-towel core or the center from a toilet-paper roll would work well.

Two different kinds of water tanks on the NP & H. Directions for making the one on the left follow on page 78.

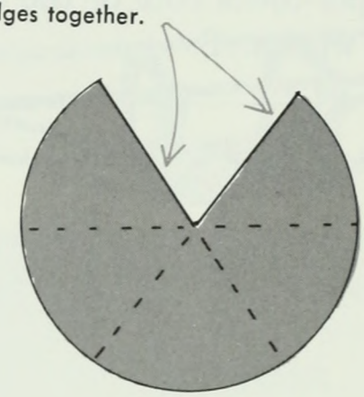




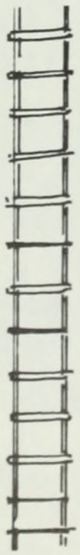
Thin strips of wood or cardboard like this can be glued on to any cylindrical shape to make a very authentic-looking water tank.



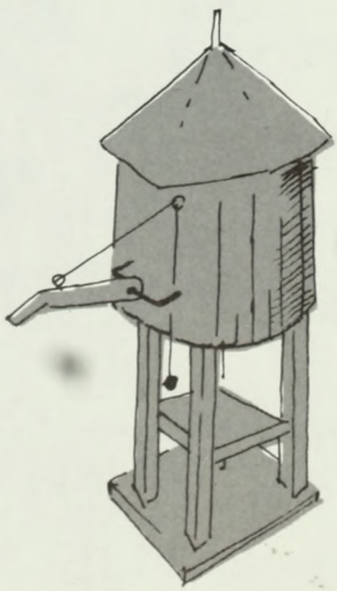
Glue edges together.



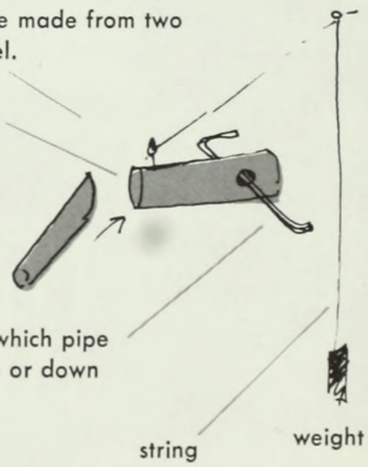
The roof can be made out of cardboard, if you score a few lines like this to ease the bending.

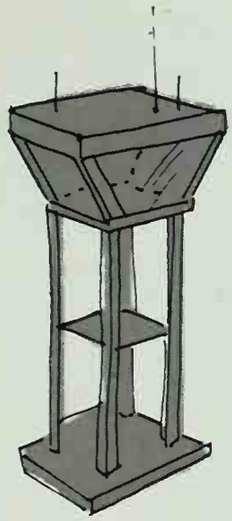


Thin dowels, applicator sticks, or even stiff wire can be used to make a ladder.

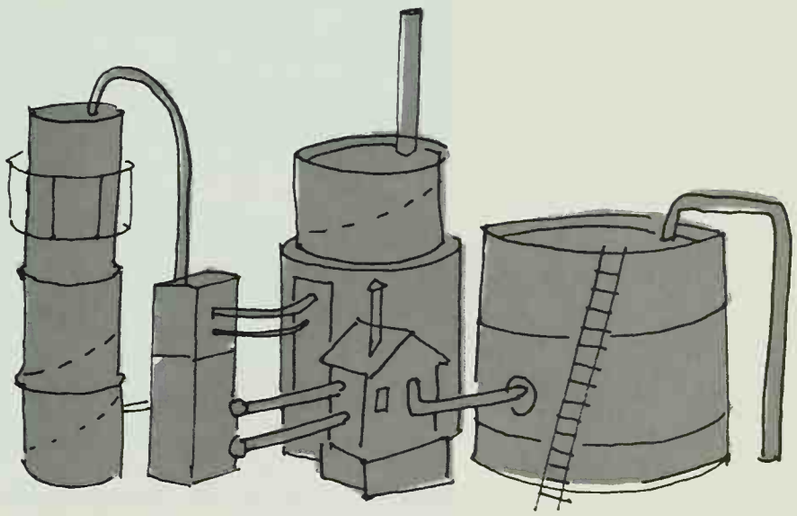


If you want your tank to look really authentic, you need a pipe like this to get the water from the tank to the locomotive. It can be made from two short pieces of dowel.





The same kind of construction can be used for the base of an airplane control tower—if you feel like including a small airport on your train table. (An airport takes up a lot of space. You had better settle for a heliport!)



A small oil refinery, or oil-processing plant, would be an interesting industry to have on any model railroad line—especially if you have some tank cars for the shipping of the oil.

HO-scale models—trains, tracks, trees, buildings, people, cars—are $\frac{1}{87}$ as big as the real thing. N-gauge models are $\frac{1}{160}$ and O gauge about $\frac{1}{40}$ the size of actual objects. If you want to be really accurate, your constructions should be to the scale of the kind of trains you have.

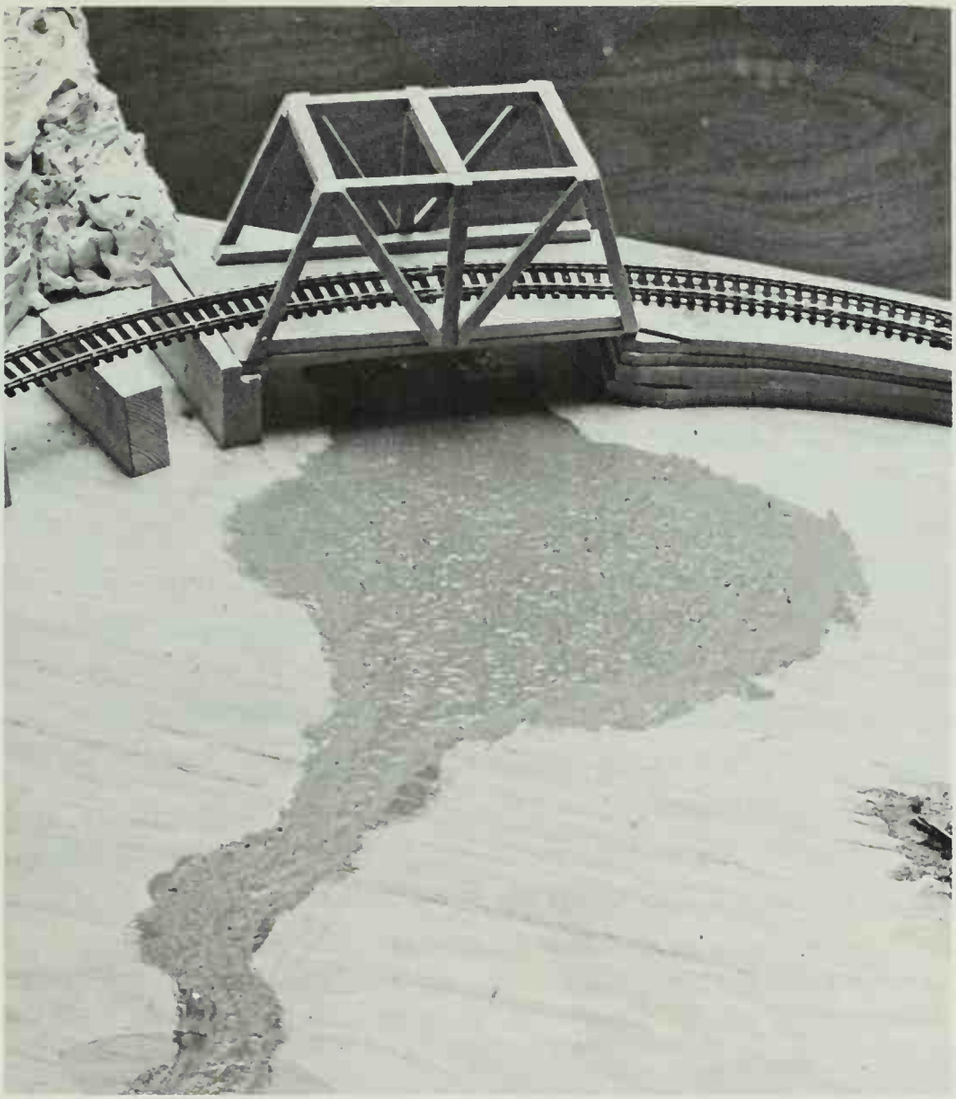
Model-train stores have special HO-scale rulers made for these measurements. They are marked in HO-scale feet. One foot in HO scale would be $\frac{3}{64}$ inch. However, unless you are very fussy, you can use your own judgment about the size and scale of the things you build. Keep a locomotive nearby as you work. Keep glancing at it and think of how it will look alongside the structures you are making.

9. Landscaping

Train tracks that run on a level surface without grass, trees, hills, and mountains are lacking something important—even if there are lots of houses, barns, and various other kinds of structures. In nature there are very few places where nothing is growing and where the land is perfectly flat. This chapter on landscaping deals with the methods of getting a model-train layout to look truly realistic—a scaled-down version of some small part of the earth's surface! After all, the earth is covered with hills, mountains, cliffs, and with forests, fields, grass, streams, rocks, ponds, rivers, gravel, and whatnot else. It is a great challenge and great fun to try to reproduce some of this in a model-train setting. Surprisingly enough, it is not the awesome task it may sound like. Here is how it's done.

Water

Rivers, streams, ponds, and lakes add variety to model-railroad layouts. They also give you an excuse to build all sorts of bridges. Water is the one element in a landscape that should be glossy—as shiny as possible. Most blue-



Several layers of thick glossy paint have been applied here, and a pattern of ripples has formed.

green enamel or glossy paints will make quite realistic water. Apply the paint fairly heavily. You can suggest ripples by making little half-moon arcs with a dull knife when the paint has almost dried, but is still soft.

You will get best results if you first paint the water, *then* add grass or gravel up to the edge of the water. Otherwise you would probably get the paint onto the material that is alongside the water.

If you can't find a glossy paint, you can get the same effect by giving the dried paint a heavy coat or two of shiny varnish.

Grass

Hobby stores carry packages of ready-made grass. It is actually sawdust that is dyed green. If you want, you can make it yourself. Get some sawdust and soak it in a solution of the kind of dye that is used for changing the color of clothing. (This is the way the sawdust ballast mentioned in Chapter 7 was dyed.) Don't use a very bright green. Most grass is actually a grayish green, sometimes even brown-green. You'll do best if you dye some of the sawdust green and some brown. Then you can mix the two colors in different proportions to get some variety. If you are lucky enough to find some sawdust from a dark wood such as mahogany or chestnut or cherry wood, you will have a handsome brown color without having to do any dyeing at all.

The grass is held in place with glue. There are special glues made for this purpose. But almost any quick-drying

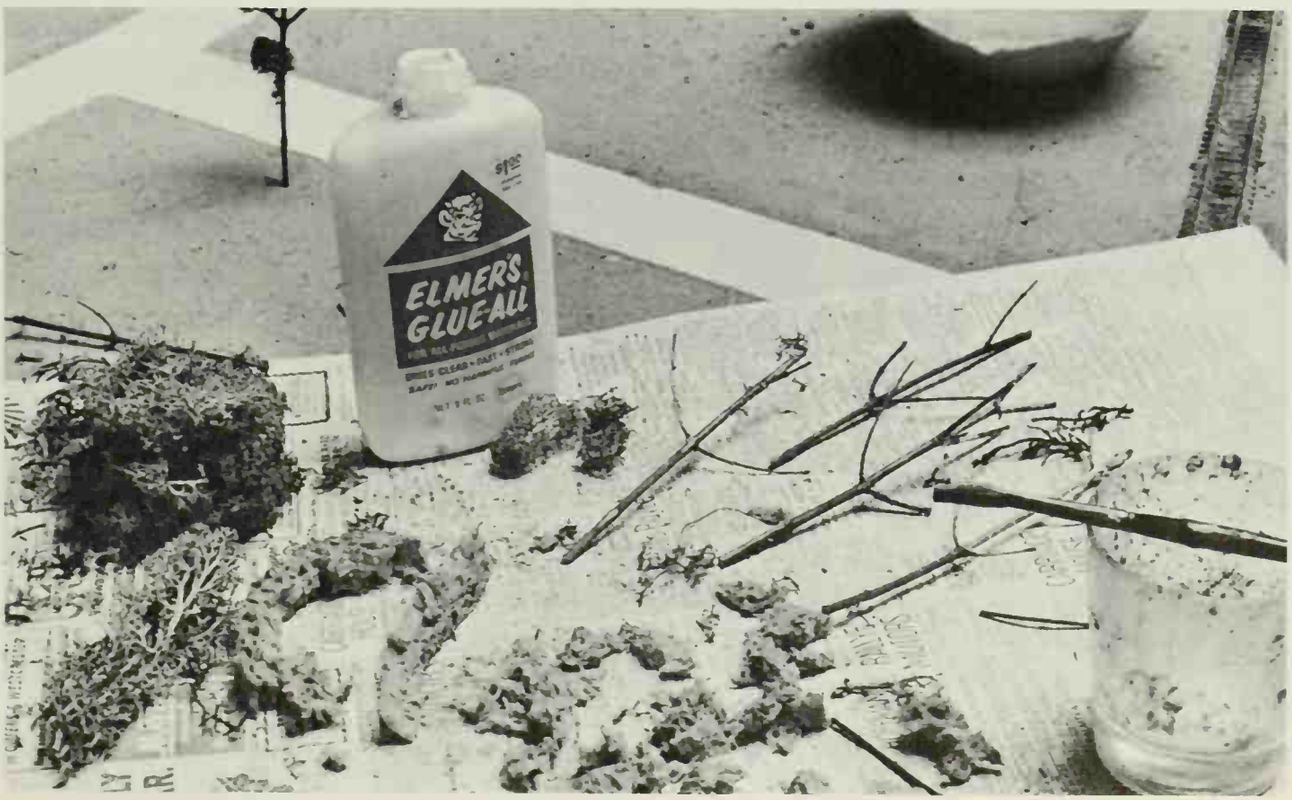
A layer of glue has been painted on the bare plywood, and now sawdust is being sprinkled onto it. The sawdust will go on more evenly if you use a strainer.

variety will work well. A white glue such as Elmer's will do the job as it did on the NP & H. Paint on the glue wherever you want grass. Use a good-size brush. Then put your grass in a fine-screen strainer. Tap the strainer so that an even layer falls onto the wet glue. When the glue has dried, brush off the excess grass.

Trees

It is possible to buy ready-made plastic trees. But all the ones I've seen look dreadful, and they are surprisingly expensive—especially if you plan to use a lot of them. It is easy enough to make your own. Most of the trees on the NP & H were made from small twigs cut from bushes growing in my front yard. Stiff, strong twigs work best. The soft, bendy kind from certain fast-growing weedy plants break too easily.

Here are the materials for tree making. The bunched-up material on the left is lichen (pronounced "liken"). The material in the center is bits of sponge. A few trimmed-down twigs, which will make the trunks and branches of the trees, are on the right.

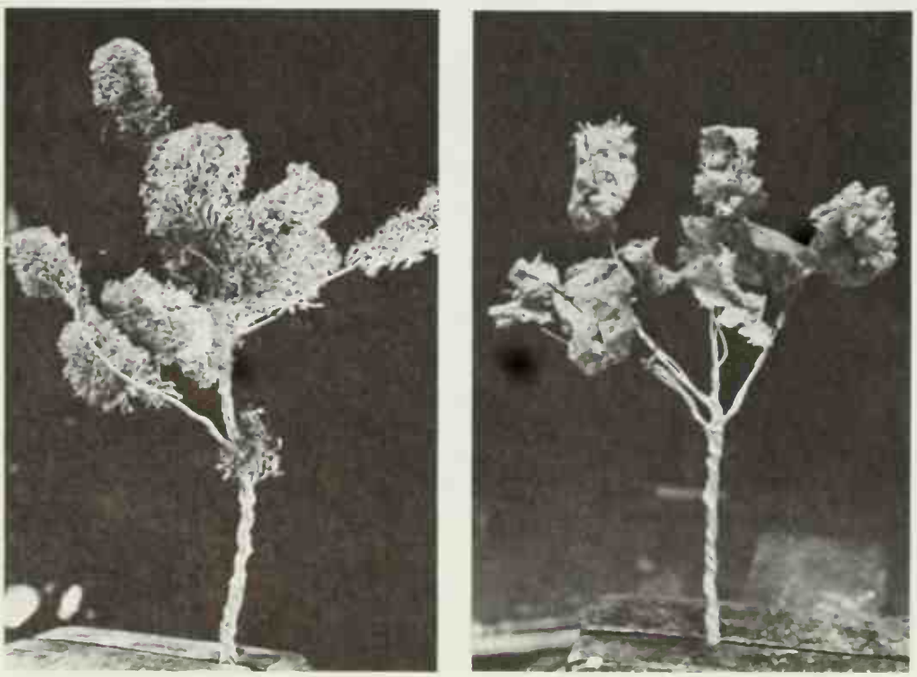


The foliage can be made from a sponge. Rip the sponge into small, loose shreds, then cement the pieces onto the twigs. Another, more realistic kind of foliage is made with lichen. This is a specially treated material sold in hobby shops. The lichen, which comes in various shades of green or brown, is separated into the shapes and sizes you want, then cemented in place.

You can also make trees from wire. Thin, uninsulated copper wire or thin galvanized-iron wire work well. Twist together eight or ten short pieces of wire—more for a larger tree. Spread out and bend the strands of wire at one end to look like branches. Then dip the whole thing in a can of brown or gray paint. Use fast-drying latex or acrylic paint to reduce the drying time. Let the paint drip off. Then hang up the tree by a branch to dry.

Trees are set in place by drilling a hole in the plywood. Drill a size hole that lets the tree trunk fit snugly. Don't glue the tree in place because you will probably change your mind sometime and want to shift your trees around.

Lichen is very useful stuff. It is also good for making bushes and the different kinds of weeds and scrubby plants that commonly grow alongside railroad track.



The tree on the left is made from lichen glued onto twisted and painted copper wire. The tree on the right makes use of pieces of sponge.

Several trees make a shady glen for some cows to browse in. All sorts of little figures and animals, such as this herd of cows, are sold by model-train stores and add a good bit of realism to any railroad setup. They are available in various sizes—properly scaled for O, HO, or N gauge.

Hills and Mountains

The most fun in landscaping comes with the building of hills and mountains. This is an opportunity for some really original construction. And the results will give your railroad an appearance and character all its own. The fastest and easiest way to make a mountain is with plaster spread over some kind of supporting structure.

Many people are afraid of plaster. If you have never used it, you may think it is a difficult and tricky material. You may expect that working with it requires all

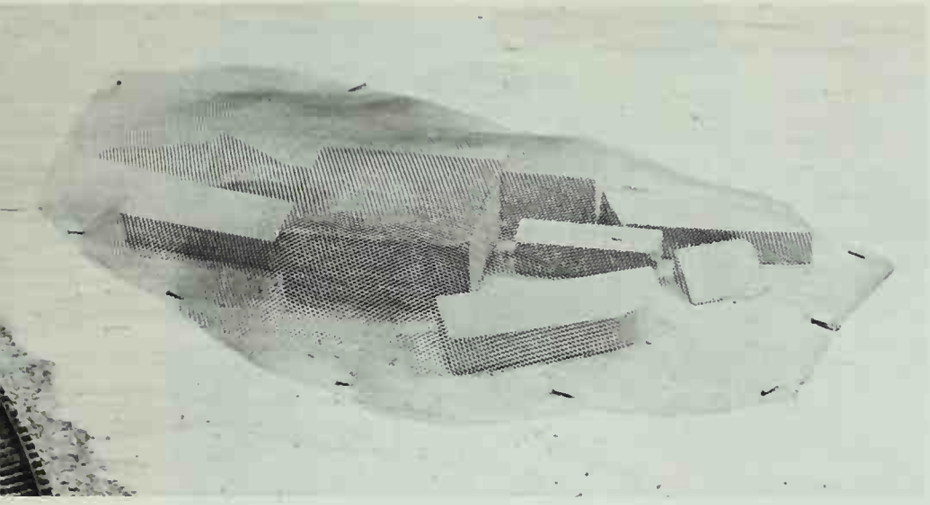
kinds of special skill and experience. Not so. Plaster is simply a white powder that you mix with water. When it dries, it becomes hard. That's all there is to it. On the next few pages are descriptions of how plaster was used to make a small hill, a mountain, and a tunnel for the NP & H.

Get a box or a bag of plain, ordinary plaster of Paris. You can buy this plaster in any paint or hardware store. Five pounds will make two or three Alp-sized mountains, plus a little hill or two, and will cost a bit over a dollar. Don't get any of the more expensive, slow-drying special plasters that are intended for grouting, or any plasters packaged in cans or small containers. These take too long to dry. You'll also need a small trowel or butter knife with which to apply the plaster and a plastic or glass bowl in which to mix it. A piece of aluminum window screening is needed and some thumbtacks or small nails.

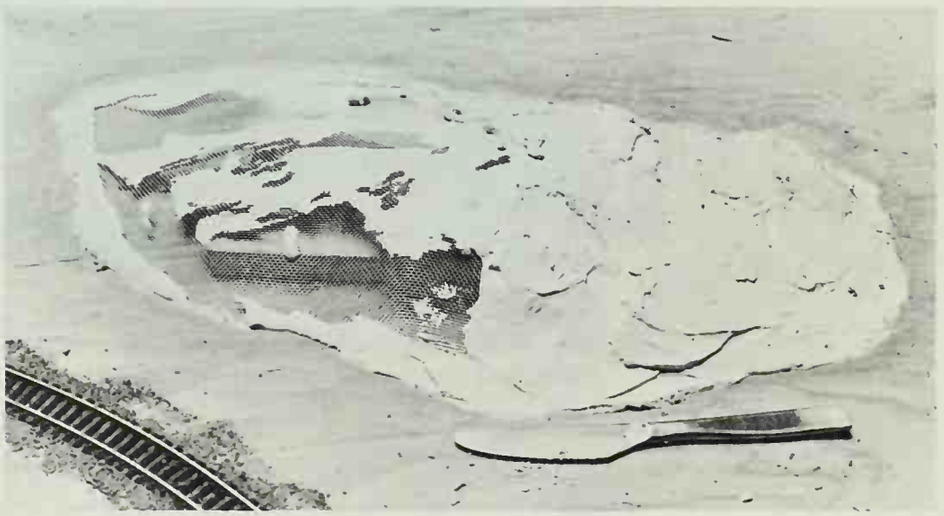
Hills

First, build the general shape of the hill by spreading a piece of the aluminum screening over a support of some kind. I used a few scraps of wood as a support, arranging them to get the kind of hill shape I wanted. Instead of wood blocks, crumpled-up newspaper can be used. Tack down the edges of the screening to your plywood board.

Next, mix the plaster. The proper proportions are two cups of plaster to one cup of cold water. Put the cup of water in the mixing bowl first. Dry the cup. Then fill it with plaster. Don't dump the plaster into the water all at once. Slowly sift or trickle it into the water *without* stirring. Add the second cup of plaster in the same way. The plaster will settle into the water, absorbing most of it. Let the mixture sit for a half minute or so, then stir.



A few pieces of wood and some window screening tacked down on the plywood—the beginning of a little hill.



The first thin layer of plaster has been spread over most of the screening.

At this point the plaster will be quite thin and watery. If you put it on the screening now, it will drip through. So wait for a minute or two, continually testing the plaster by scooping out a small dab with your knife to see what the consistency is. In a short time—three or four minutes—it will begin to thicken. It will become like thick cream. When it gets like this, it will stick to the screening without dripping through. Now you have to work fast! The plaster will continue to thicken, and you have only two or three minutes before the plaster becomes too thick to use. Pick up generous scoops of the plaster with your knife and spread it over the screen. The action is like buttering bread. Try to get a layer about ¼ inch thick. Smooth the

Here is the finished hill, which blends into the surrounding countryside. It has been covered with "grass," and has a water tower perched on top. The more rugged mountain is described on the next few pages.

plaster over the edges of the screen and onto the plywood base.

You'll probably find that there are places you missed or areas where you want more plaster. But before you mix another batch, you must clean out the mixing bowl thoroughly. Plaster should be mixed only in a spotlessly clean bowl. To clean the bowl, wipe it out with newspaper if there is still wet plaster in it. Otherwise, scrape out the hardened plaster with a knife. All leftover plaster, either hardened or liquid, should go into the garbage can—not into the sink, where it will cause clogging.

When you apply a fresh batch of plaster over plaster that has already hardened, the first layer should be wetted

down. Sprinkle on clear water with a big brush or a sponge. If you don't do this, the water from the second batch of plaster will be quickly absorbed into the first layer. The second batch will harden before you can smooth it out.

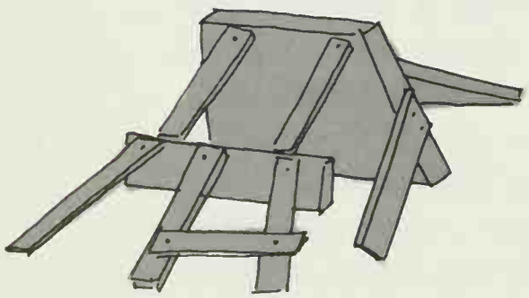
If you don't have any wire screening, there is another way of working that will produce similar results. Build up the shape of your hill with scrap wood or bunched-up newspaper as before. Then get some burlap or other coarse, open-weave cloth. Cut it into strips about 2 inches wide and 8 inches long. Mix your plaster as described above. But don't wait for it to thicken. As soon as it is mixed, dip a strip of cloth into the plaster so that the strip is completely covered. Then lay the strip down over your hill shape. Keep doing this, crisscrossing the strips, until the hill is completely covered. This may take several batches of plaster. When the hill is completely covered and the plaster has hardened, dampen the plaster. Add another layer of plaster and smooth it down.

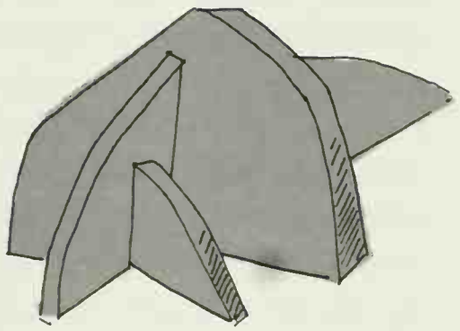
There is yet another way of working if you can get neither plaster nor wire screening. That's with papier-mâché. Make your hill shape in one of the ways already mentioned. Cut newspaper into strips about 2 inches by 8 inches. Fill a small bowl about half full of water. Add wallpaper paste, or flour, until you get a thick pastelike mixture. Then dip a strip at a time into this mixture. Place it on your hill form. Continue doing this until you've built up ten or twelve crisscrossed layers of paper. If you find that the hill seems to be getting too wet and soggy, add an occasional dry strip of paper. And don't be alarmed if you seem to be getting a sagging, mushy lump! When the paper has dried, you'll find that the forms are strong and firm. The only trouble with working this way is that it will take a few days for the papier-mâché to dry.

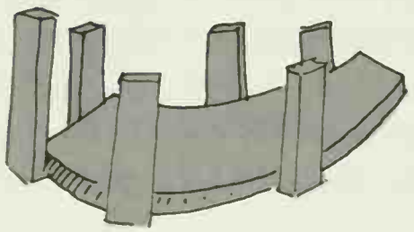
Mountains

Mountains are built in the same way as hills. However, plaster is more suitable than papier-mâché because of the larger size. For this same reason the underneath support or framework must be a little more carefully constructed. A bundle of newspaper or a few scraps of wood won't make a mountain shape. The drawings show some of the possible ways of building a mountain framework.

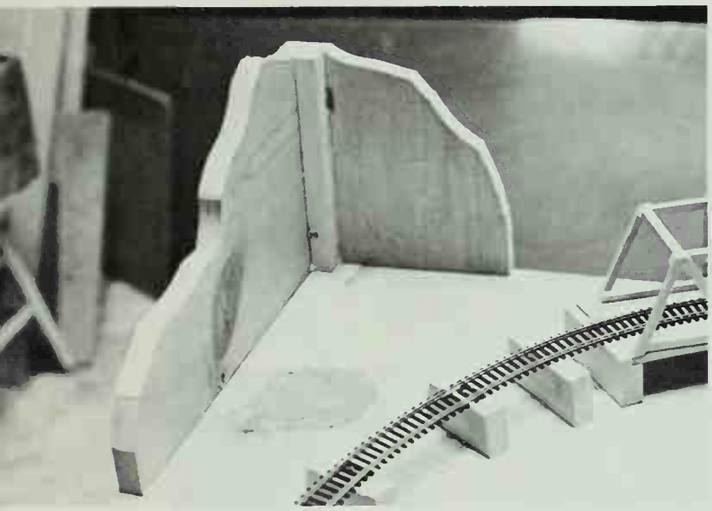
There is something else about mountains—especially the rather steep ones that are most suitable for model-railroad landscaping. They aren't likely to be smooth and rounded like a hill. And if they are steep, they will be rocky, craggy affairs. That means you must somehow suggest rocks and stones and a jagged surface that will look

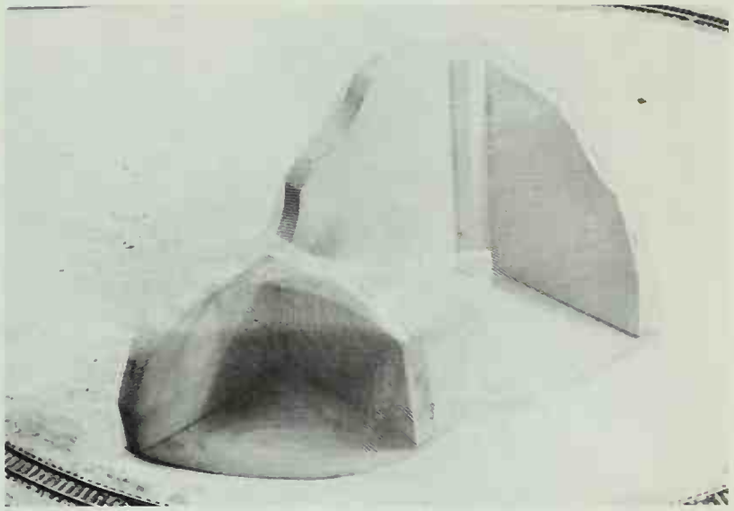


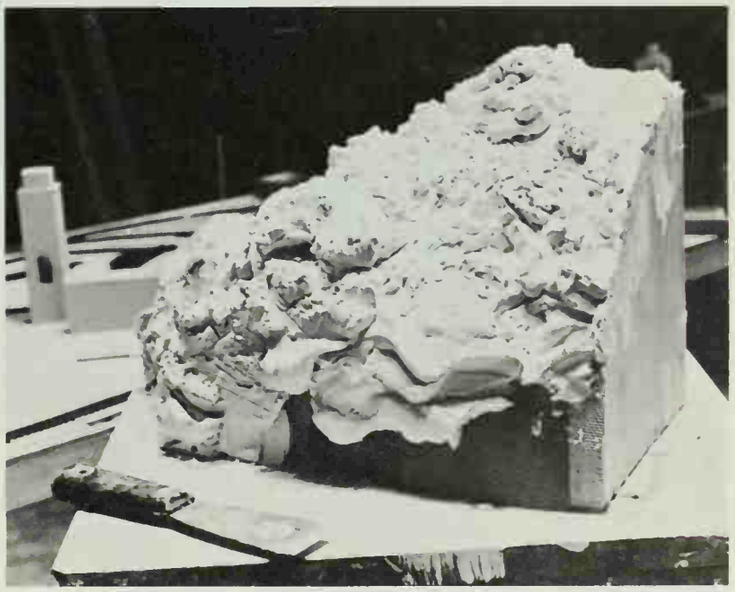




These drawings show a few possible ways of building the inside support for a mountain. Even though precise carpentry isn't necessary, you'll probably feel better if the construction is as neat and sturdy as possible.





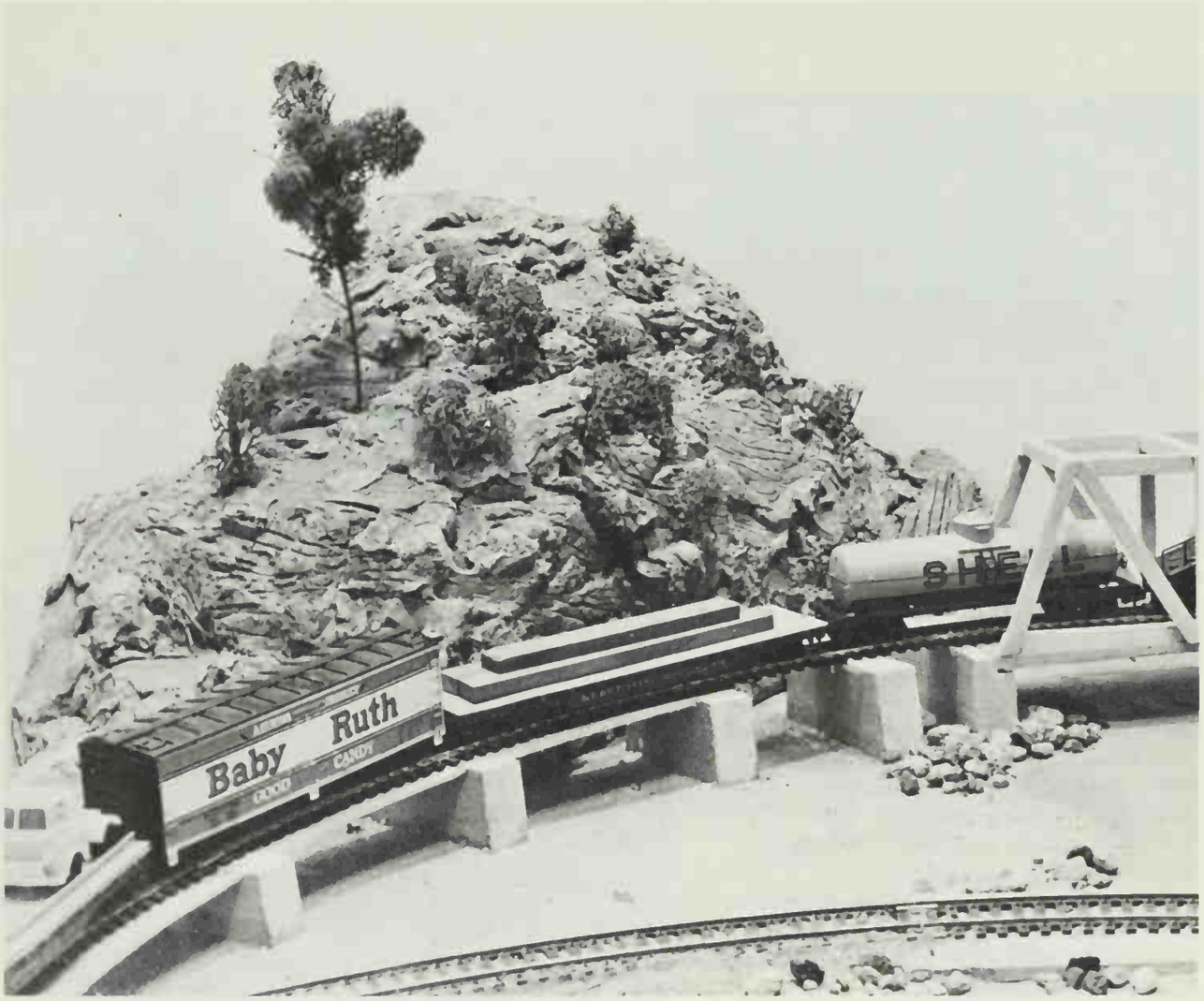


The photograph above shows the start of our mountain. Because it had to fit into a corner of the plywood table in a rather small space, two sides of the mountain were made straight up and down in shape.

In the upper right-hand picture an extra piece of wood has been added, and screening has been stapled on. The screening was not attached to the table—so the mountain is movable.

On the right, plaster has been applied over most of the screening. Notice how the surface has been kept rough and craggy.

realistic. The way to do this is by applying your plaster to the screening or cloth with great abandon! Don't smooth on the plaster. Splash it on in heavy globs and lumps. As it begins to harden, shove it about; slice into it; rough it up with fingers, knife edge, screwdriver. Here and there you can cut flat, vertical sections to look like cliffs,



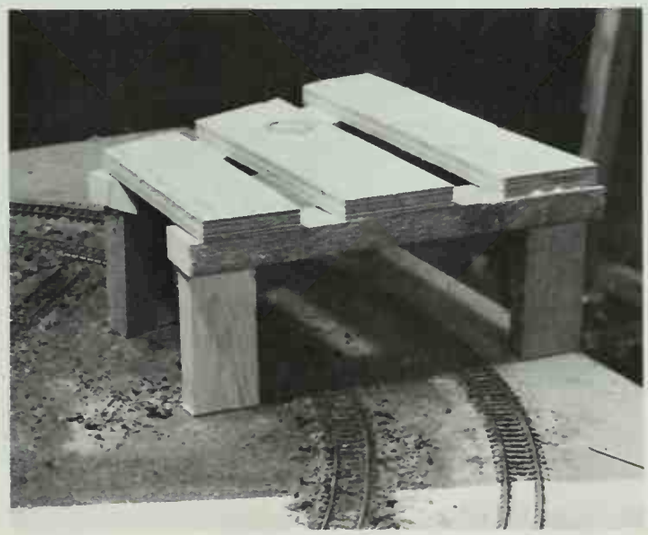
And here is the finished mountain. It has been painted with washes of thinned colors —various shades of gray and brown—and a tree and a few bushes have been set in place. Notice how some gravel was placed at the base of the bridge and along the tracks.

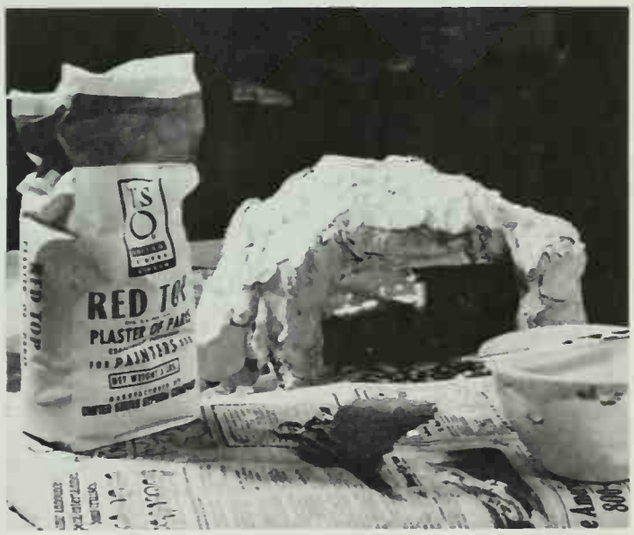
or in some places you can cut straight horizontal or diagonal lines to suggest the cracks and fissures found in some rock.

When the plaster has hardened, look it over to see if there is anything you want to add. And if there are any sections you don't like, chip the plaster away with hammer and screwdriver or with a chisel until you get the effect you want.

Tunnels

These are made just as a mountain is made. However, you must plan your framework so that there are no supports in the area where the track will go. I found that the tunnel for the NP & H was easy to make using a tablelike form to cover the track. This was then used as a base for the screening or cloth.





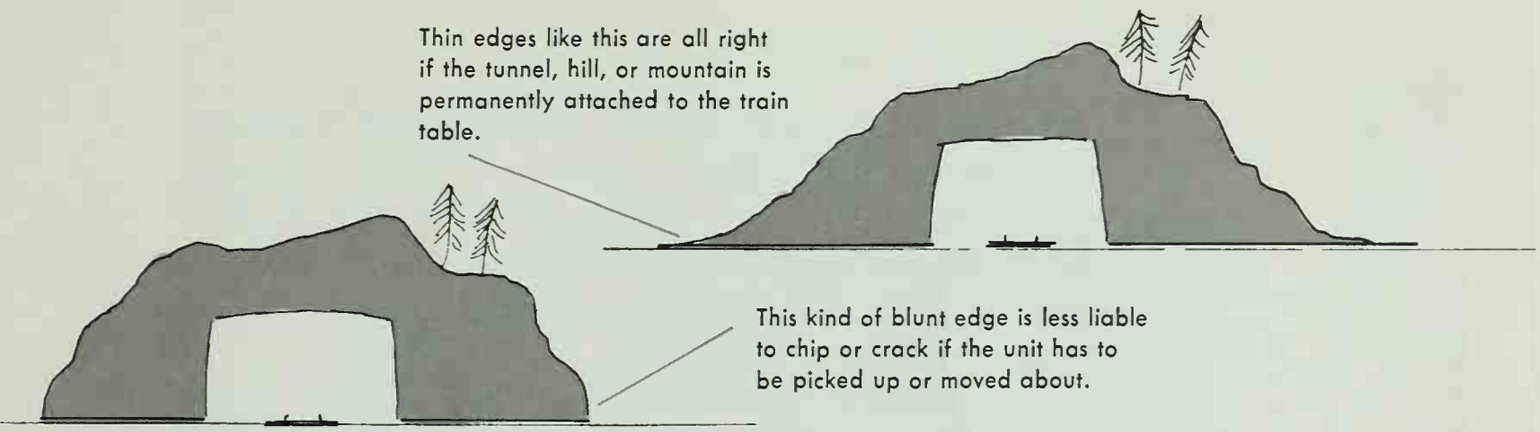
The framework for this tunnel was made from a few pieces of scrap lumber.

Above right, screening has been nailed on over the wood framework, and plaster has been applied.

On the right, washes of thinned color are being brushed on.

The finished tunnel. This tunnel was built after the NP & H had a second line of track added, so it is fairly wide. Here again some gravel has been placed along the base. It hides the bottom edge and looks like the sort of thing you'd see at the foot of any real, full-scale, steep embankment.

If your railroad has to be put away when not in use, perhaps stood on its side or placed one end up against a wall, large projections such as mountains and tunnels get in the way. In this case it is best to build these additions so that they can be removed. To do this, you should spread waxed paper on the plywood before you do anything else. You also won't be able to nail down any screening. When



you apply the plaster, or papier-mâché, if that is what you are using, it is important to build up the edges so that they are strong. Thin, fragile edges that blend into the plywood base will break and chip when the mountain or tunnel is handled.

Painting

Any kind of paint—oil, acrylic, latex, artists' watercolors —can be used to paint your landscaping. But the paint should be very, very thin. Dilute oil paints with lots of turpentine, water-based paints with lots of water. You should, in fact, be *staining* rather than painting. If your first application of paint seems too thin, it is a simple matter to go over it again. The only paints to avoid are those that dry with a shiny surface. Don't use enamels or high-gloss paint. There are very few shiny surfaces in nature.

You can get some very nice-looking, realistic effects by putting on one color, then going over it a second time with a somewhat different shade. You'll also find that thinned paints will soak up into the cracks and rough areas of plaster more than into the more exposed or smooth surfaces. This will produce interesting variations.

Hills and mountains are made of rock and earth, and they therefore should be painted earth colors: browns and

grays. If a hill or mountain appears green, this is because something green, like grass or bushes or trees, is growing on it. If you want some green growing things on your landscaping, add green sawdust for grass, or green lichen or bits of sponge for trees and shrubs. Think twice before using a bright green paint.

Fallen rocks or piled-up boulders can be suggested with real pebbles and coarse sand. If you come across a small rock with a shape and color you like, pick it up and take it home. See if it can't be incorporated into your landscaping arrangement somewhere.

Roads are an important part of any model-train world. The easiest way to make one is simply to paint it directly on the plywood. A better way to make a road is to cut out strips of cardboard in whatever width you want the road to be and then paste them down. You can also paste cardboard between the rails where the road crosses the track.

The cars and trucks that you can see here and there on the roads that border the NP & H go well with any roads

Here is a plain strip of cardboard pasted down onto the bare plywood to make a road. Notice how a thin strip of cardboard has been pasted down over the track ties where the road crosses the train line.

This is the way the finished road looks after painting and a lot of grass "planting" and general landscaping.

you may make. The common or garden variety of little metal cars and trucks that many people have are too big and out of scale for HO gauge. They are all right for O gauge, but for HO or N gauge, you'll need much smaller vehicles. These can be bought at most model-train stores.

When you plan your landscaping, decide on the locality you want to recreate. If you want your trains going through a rugged New Mexico scene, for example, you would want to use lots of brown coloring, low shrubs, dead twigs (bones?), to create a sandy, barren, sun-bleached look. If you wanted a New England setting, you might decide on many trees, rolling hills, farms, stone walls, and so on. If you want a railroad going through the sort of countryside where you live—or would like to live—think about the landscape there and the particular geographic features that appeal to you. This sort of planning will give your railroad a personality and purpose, and will make it much more interesting.

10. Operating the Railroad

A model railroad, just like a real one, must earn its keep. It can't just run around in a circle looking handsome. A passenger train has the job of getting people from one place to another. A freight train should pick up and deliver freight.

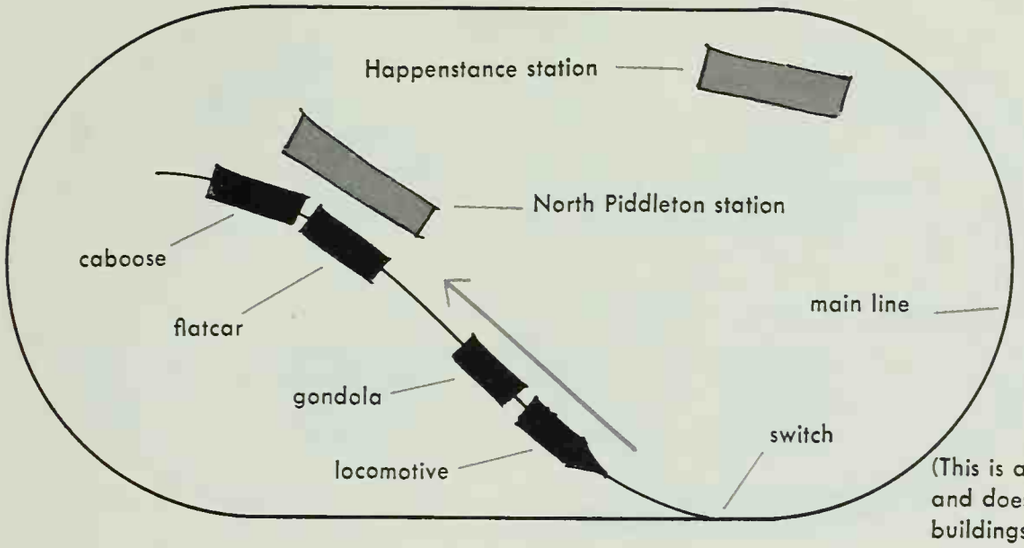
Some of the actual, real-life operations of a railroad can be realistically reproduced in the model. Trains look and act like the real thing. So do switches and track and many of the accessories you can buy or build. But your imagination must add a lot more. You must imagine crowds of people getting on and off the passenger trains, factories producing goods to be shipped, stationmasters directing loading and unloading. Instead of your fingers working a derrick, you must think of a crew of yardmen doing the job.

The question of distance will also require that you make use of your imagination. For example, on the NP & H the distance from North Piddleton to Happenstance is only about 48 inches. That's not very far. In fact, my train can cover that distance in about 8 seconds—start to stop. Not very realistic. But the problem is easily solved. I simply

Here is a view of the NP & H taken one day when I decided that North Piddleton University should be off in a corner and other buildings placed elsewhere. The derrick and water tower were temporarily removed, and Happenstance station happens, somehow, to have been placed in an empty lot in the lower left corner. (Nothing stayed the same way for very long on the NP & H. As you can see, landscape, structures, and anything movable were always being shifted about.)

say that in order to get from North Piddleton to Happenstance the train must go around the track five times!

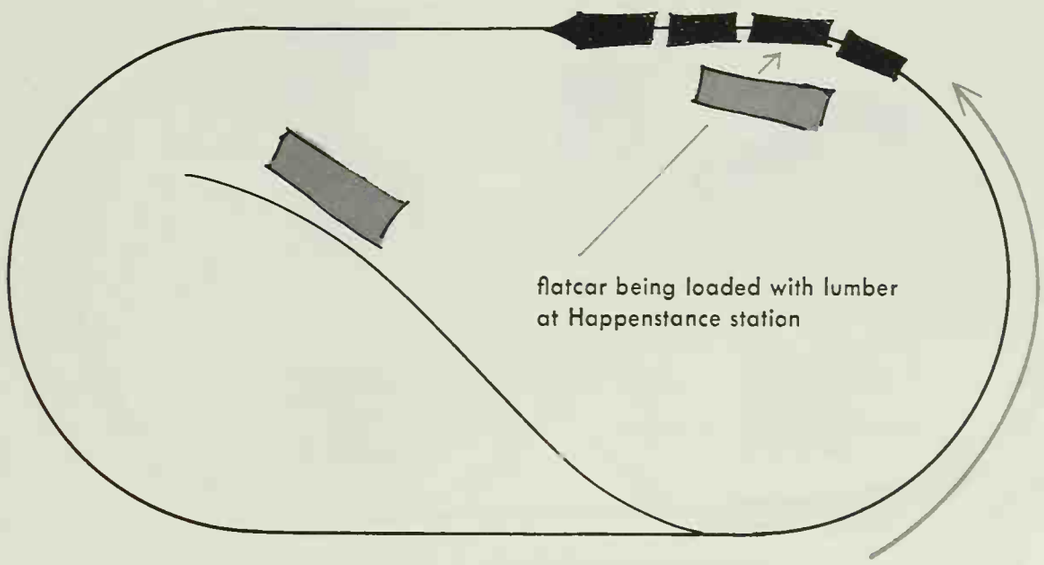
The following paragraphs describe a typical freight operation on the NP & H. Even though the layout is the very simplest, you'll see that quite a variety of action is possible. There is nothing special or recommended about the operation. But it may give you some idea of what can be done with your trains. You will probably have all kinds of different ideas of your own.



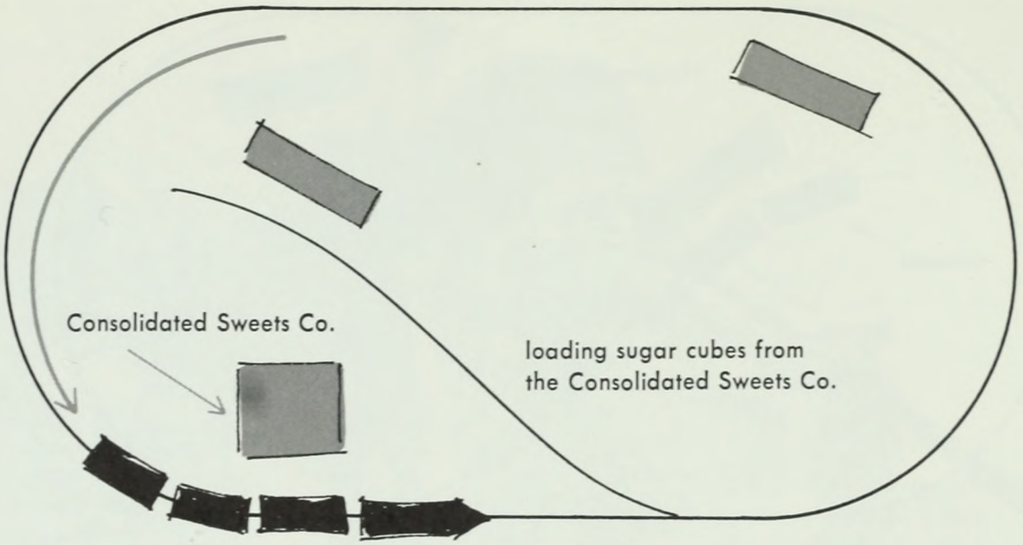
(This is an imaginery train operation and doesn't correspond to any of the buildings shown in the photographs of the NP & H.)

Our locomotive, with the gondola already coupled on, backs up into the North Piddleton station. It picks up the caboose and a flatcar that were "parked" there overnight. With these two cars coupled on, the train goes forward, through the switch, onto the main line. (The switch must be positioned properly or there will be a derailment.) As soon as the train is on the main line, the switch is set for straight-through operation.

The train speeds up, going five times around the main line. It stops at Happenstance station. Here the derrick is put to work, loading some lumber onto the flatcar.

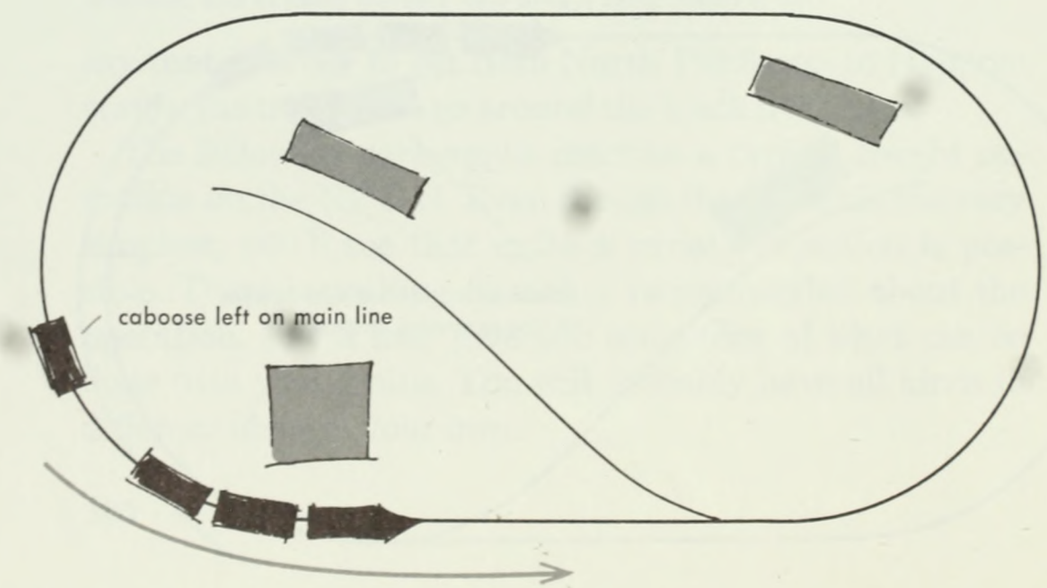


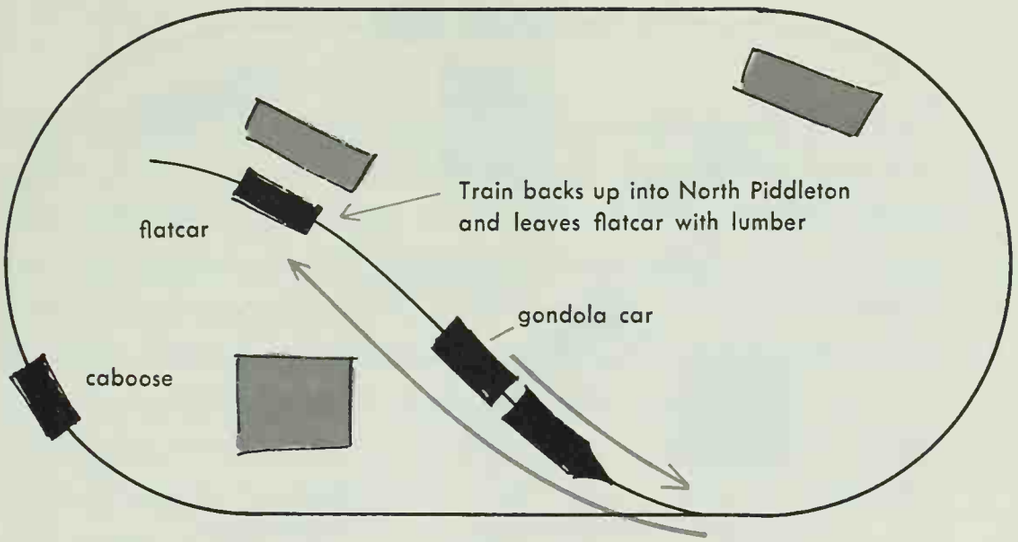
flatcar being loaded with lumber at Happenstance station



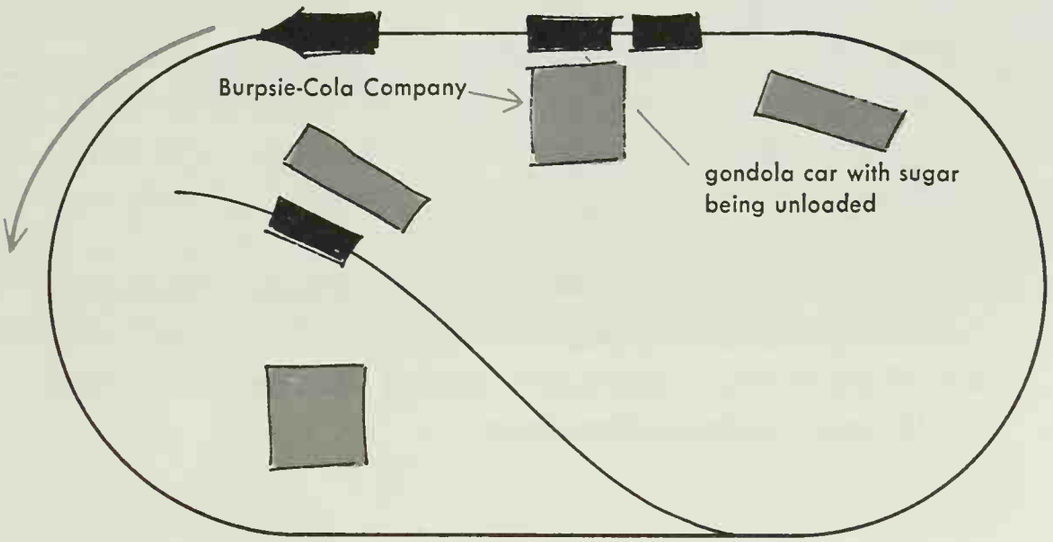
Then the train is on its way again. It makes another few turns on the main line and stops alongside the Consolidated Sweets Company to take on a load of sugar cubes. These are loaded into the gondola car. Now the train is fully loaded. The lumber must be delivered to North Piddleton, and the sugar to the Burpsie-Cola bottling plant which is located near the Happenstance station.

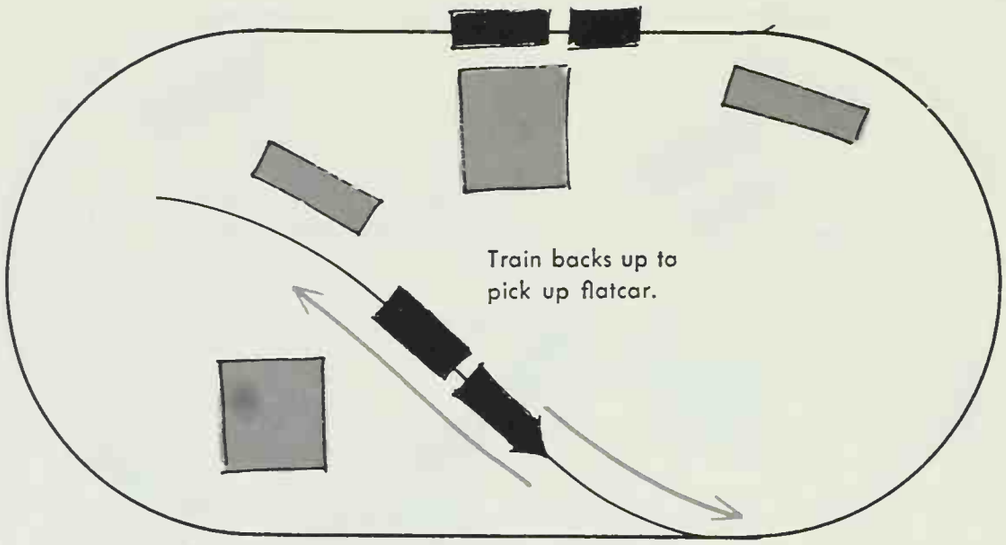
The train makes several turns around the main line. Perhaps it stops for coal and water along the way. The train then stops to the left of the North Piddleton turnoff. The caboose is uncoupled and left standing on the





main line. The train goes forward, past the switch. The switch is thrown, and the train backs up to the North Piddleton station. The flatcar with the lumber is uncoupled and left there to be unloaded. The train goes forward, back onto the main line. The switch is flipped back to straight-through operation. Then the train backs up to pick up the caboose again. After all, the caboose must be at the end of the train. Then off around the main line for a few more turns. Now the sugar must be delivered to the Burpsie-Cola bottling plant. we leave the gondola car with the sugar, as well as the caboose, next to the plant





to be unloaded. (The caboose has to be left there, too, because it is behind the gondola car.)

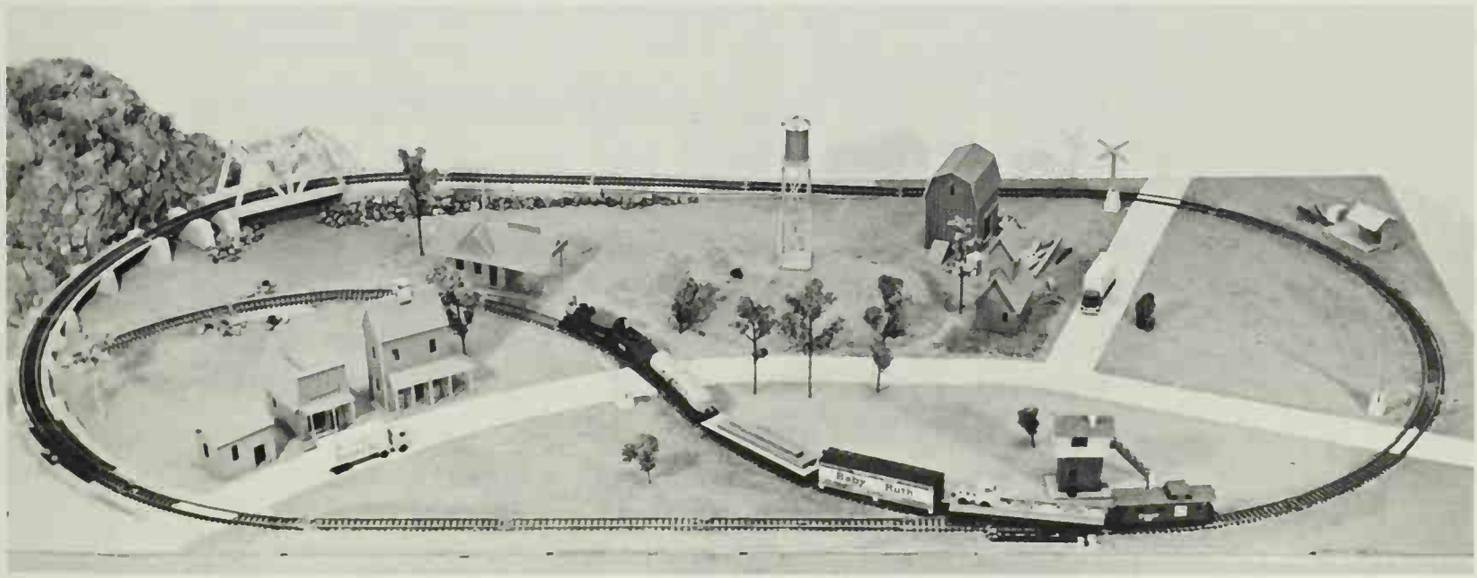
The main line is blocked now while the unloading is going on. (If the bottling plant had been off on a siding, the main line would have remained open.) But the train can travel around the loop and again back up to North Piddleton to pick up the flatcar, which has been unloaded by now. Next it goes on to the main line and backs up to pick up the gondola car and caboose. And then our train is off for another load or sets about doing some other important job that is vital to the well-being of all the people who live and work along the NP & H.

This may sound a bit complicated—but that is only because you are reading about it and not doing it. Actually, once you get the hang of running a model-railroad line, you will look for all kinds of freight or passenger problems to make the action as busy and complex as possible. This is especially true when two or more people are working with the trains. One person can work the throttle; another take care of the action at one location; and perhaps still a third handle some business elsewhere.

There are, of course, all kinds of combinations of movement of freight and passengers, and the sort of cars you own will have something to do with the sort of operations you undertake. If you get tired of one kind of operation, it is a simple matter to change the nature and location of stations, industries, loading places. None of these structures have to be permanently fastened down.

If there were more trackage, more sidings, more industries, it would be possible to get more complex switching and more varied train movement. In order to achieve this more interesting activity, the NP & H was modified as explained in the next chapter.

Here is a bird's-eye view of the NP & H before the track arrangement was expanded. In this photograph the train is running in a different direction than that shown in the drawings on the preceding pages. The North Piddleton station is on the branch line, just in front of the locomotive in this picture. Can you figure out what you must do to leave the caboose by itself in front of the North Piddleton station and have the rest of the train running on the main line? (A hint: there is some locomotive pushing involved.)



11. Getting Bigger and Better

No model railroad is ever finished. There are always changes, modifications, extensions, or improvements, either in progress or planned. One of the changes for the NP & H that I always had in the back of my mind was an inner oval that connected to the outer one. With an arrangement like this, two trains could be run at the same time. There would be possibilities for more varied train movement with lots of switching and shifting about of freight or passengers.

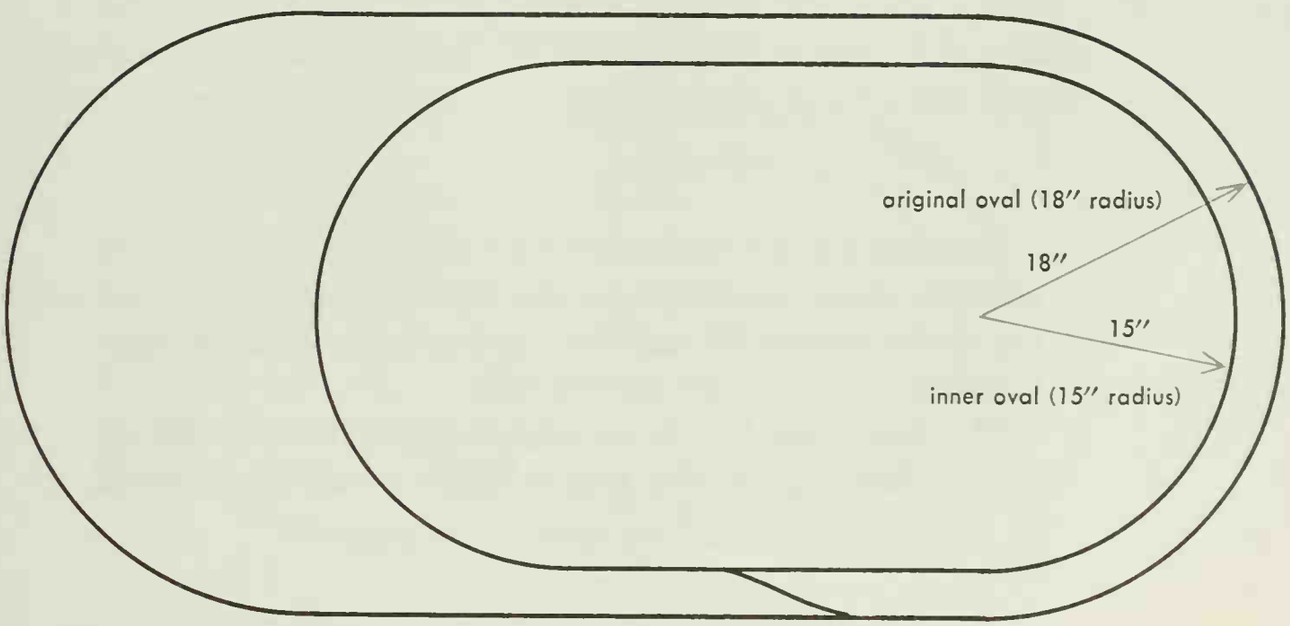
One of the nice things about a two-train operation is that you can have a friend who owns trains like yours come to visit (with his or her trains) and run them along with yours. There are all sorts of interesting train happenings when two people are running two separate trains. Watch out for collisions, derailments, competition to pick up freight, right-of-way conflicts, and other fascinating complications. But even with only one train, an inner loop is still a very considerable improvement.

On the next few pages I will explain how I changed the original oval and spur line of the NP & H into the layout shown. This plan is just one of any number of possibilities and not necessarily one that you would follow if

you were expanding a simple oval of your own. But by following the various steps I took and understanding what was done, you'll be able to handle similar situations.

My new track had to be added inside the original oval. I had no choice. There was no room anywhere else. This immediately presented a problem. My curved track was 18-inch radius. I obviously couldn't fit another 18-inch-radius track inside. If I had been using a larger sheet of plywood, I could have added 22-inch-radius track *outside* the original oval. This would have been preferable if possible. However, there is such a thing as 15-inch-radius track. And this is what I used for the inside oval.

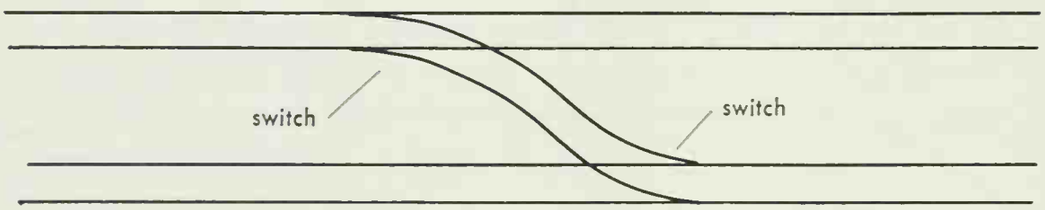
There is one serious drawback to using small-radius track like this. Because it makes a tight curve, large locomotives or large passenger cars cannot use it. The wheels will bind and derail. However, large locomotives with many long cars don't look good on a small layout; and anyhow, the NP & H had only small locomotives with normal-sized freight cars. So I felt that I could safely use the 15-inch radius track.



I bought twelve pieces of this kind of track, a few pieces of straight track, and some switches. I removed everything that was removable—mountain, tunnel, buildings, trees—and pulled up the North Piddleton branch line. Because my track was held in place by ballast and glue, with no nails, a knife gently poked along under the ties did this job with no trouble.

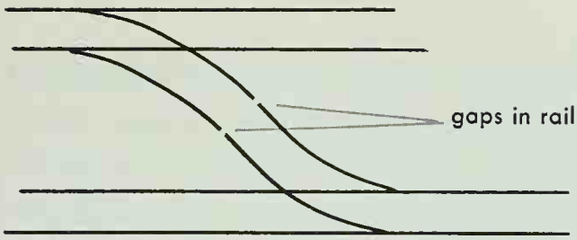
Then I laid out the smaller oval inside the original one. I placed it off-center to the right because I thought it looked better that way, and I wanted to keep it away from Piddleton Creek, which runs under the bridge, you know!

The oval looked fine, but now I had to connect the two sets of track. I did this by means of the two switches as shown below. Both sets of track were electrically connected to the power pack now. I could make my train go from one set of track to the other simply by flipping the two switches.



But this was not yet a two-train operation. If I were to put two trains anywhere on the tracks, they would *both* run at the same time, and start and stop at the same time. I couldn't control them individually.

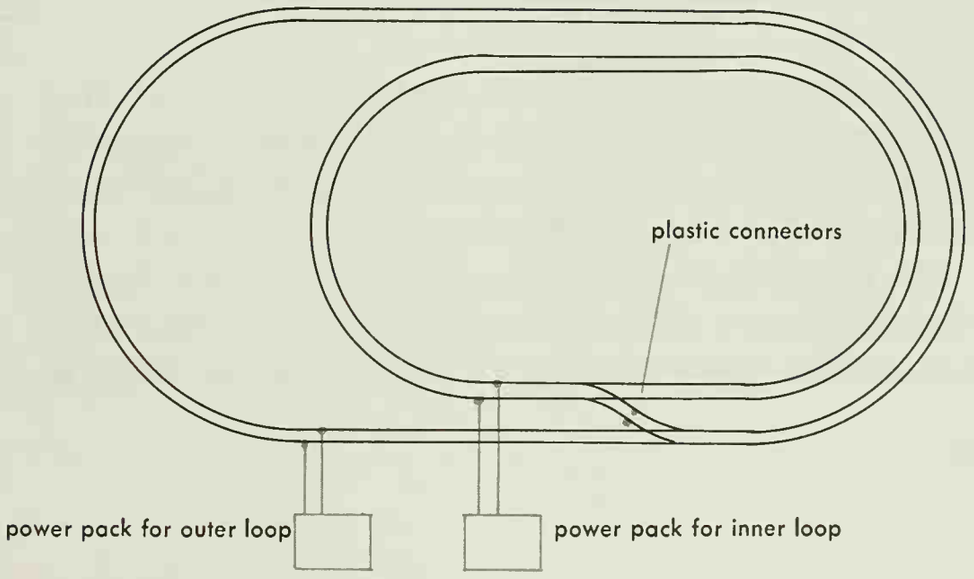
The two ovals had to be separated electrically. To do this, I disconnected the two switches where they joined



a plastic connector

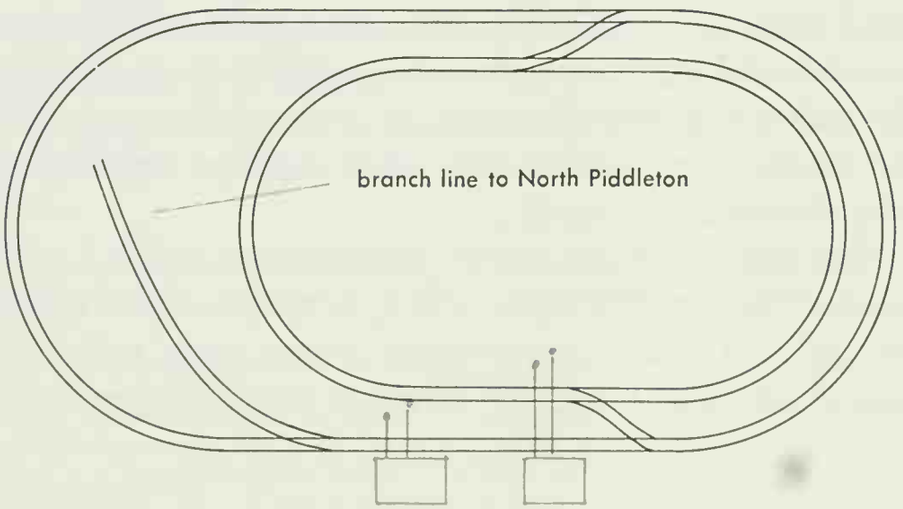
the inner to the outer oval. I removed the two brass connectors that held the tracks together. I replaced them with two plastic connectors, then replaced the switches. Now there was no electrical connection between the two ovals because plastic connectors are insulators. Plastic connectors for this purpose are sold in model-train stores. They will slide in place with no fuss. If you don't want to buy these connectors, you can get the same results by sawing through the track with a hacksaw, or better, with a small razor saw. (This is a very useful tool for all kinds of model work and well worth having.) If you do saw a gap in the rails, rub a drop of cement or glue into the gap. Then the tracks won't accidentally shift together and electrically reconnect the ovals.

Now that I had the plastic connectors in place, I could run my trains on the outer oval. But the inner oval had no electricity. I had to get a second power pack, and a section of terminal track. (A terminal track section is one



with provisions for attaching wires.) When this was done and the wires connected, I could run two trains at the same time. One power pack controlled the inner oval; the other power pack controlled the outer one. If I used only one train I could shift back and forth between ovals, changing from one power pack to the other for control, depending on where the train was.

There was one thing I didn't like about this arrangement, however. In order to get from the inner oval to the outer one, I had to back up the train. In order to avoid this, I put in another pair of switches on the far side. This was done in exactly the same way as the first pair of switches, using two plastic connectors.

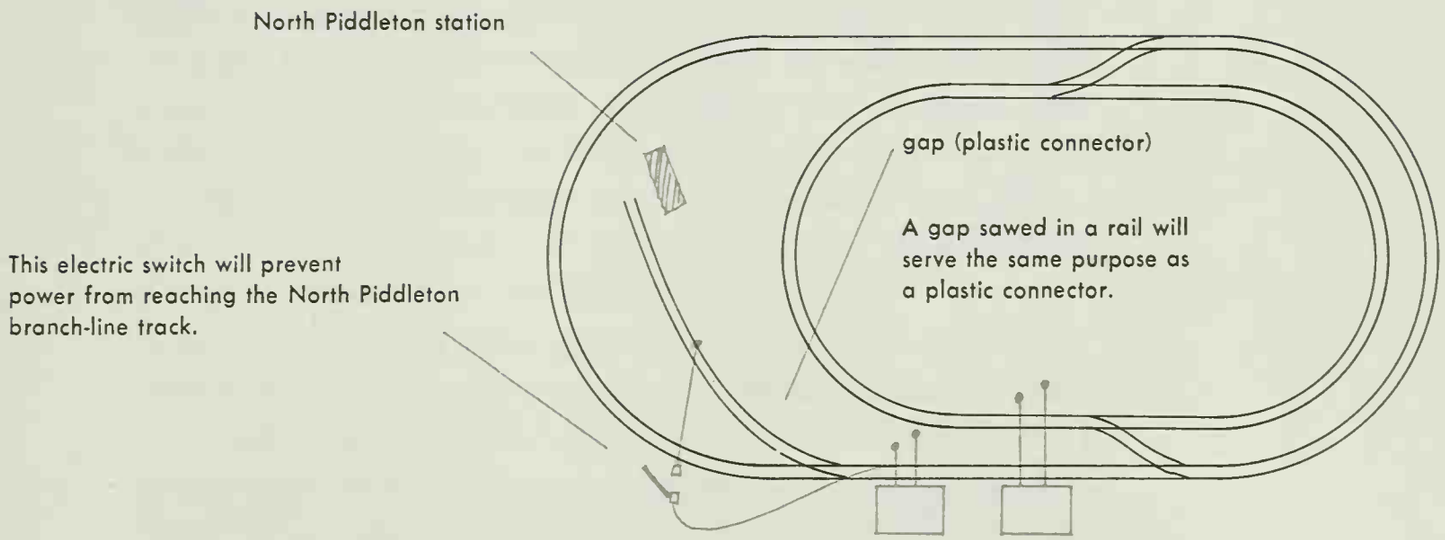


In the course of all this fitting and track-laying, I found there were some places where I needed special lengths of track. These were cut as needed and installed as explained in Chapter 6.

The next thing was to add a branch line to a relocated North Piddleton. This required one more switch set into the main line (the outer oval) and a few sections of track.

After running two trains here and there, exploring different types of operation, trying to avoid collisions, I found there was a problem. There was no place I could "park" one train when I wanted the other train going back and forth between ovals. In other words, I couldn't get one of the trains out of the way when I didn't want to use it.

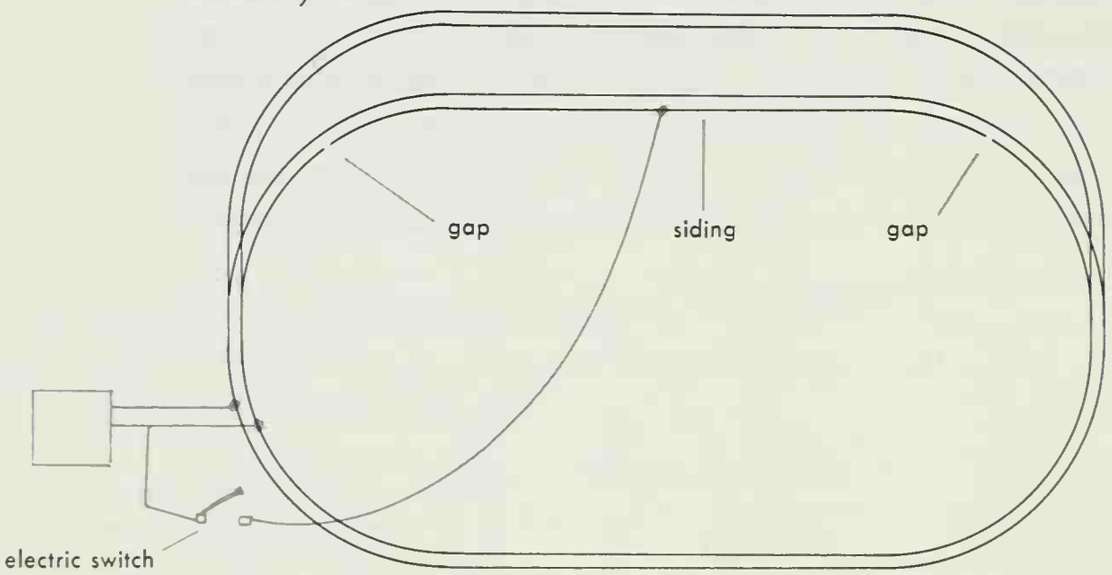
There is an easy solution to this, though. I put a plastic insulator in the track leading into the North Piddleton branch line. I also had to put in a terminal section of track so that an electrical connection could be made. In order to get the electricity to this line when I wanted it, an electric switch was connected to the wires as shown below.



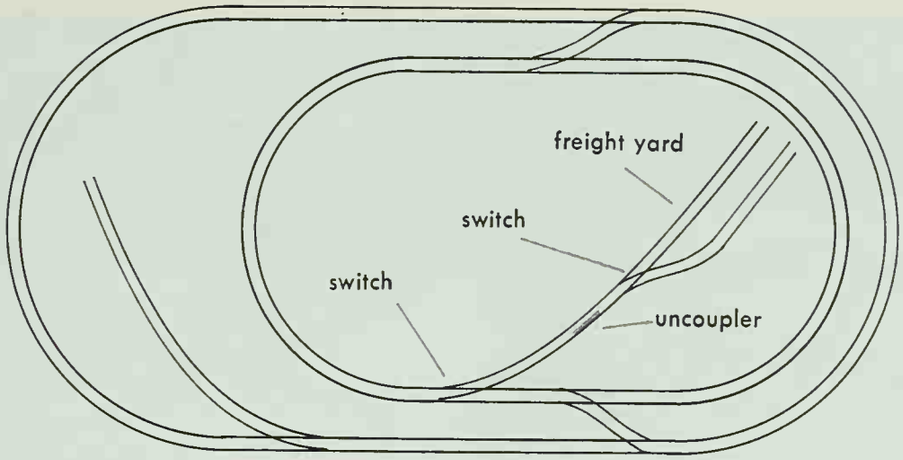
Now a train could be run onto this line. Then the switch could be opened (switched off), which would interrupt the circuit. No electricity could get to the tracks. And the train would just stay there out of the way until I needed it.

The electrical separation of a section of track like this is called "block control." It is used a great deal in large

model-railroad setups and permits all kinds of interesting operations. An example of a slightly different kind of block control is shown below. In this case there is a siding. If two trains are on one track and you want to get one train out of the way, switch it onto the siding so the other one can pass. The power to the siding tracks can be cut off simply by flipping a switch (an electric switch, not a track switch).

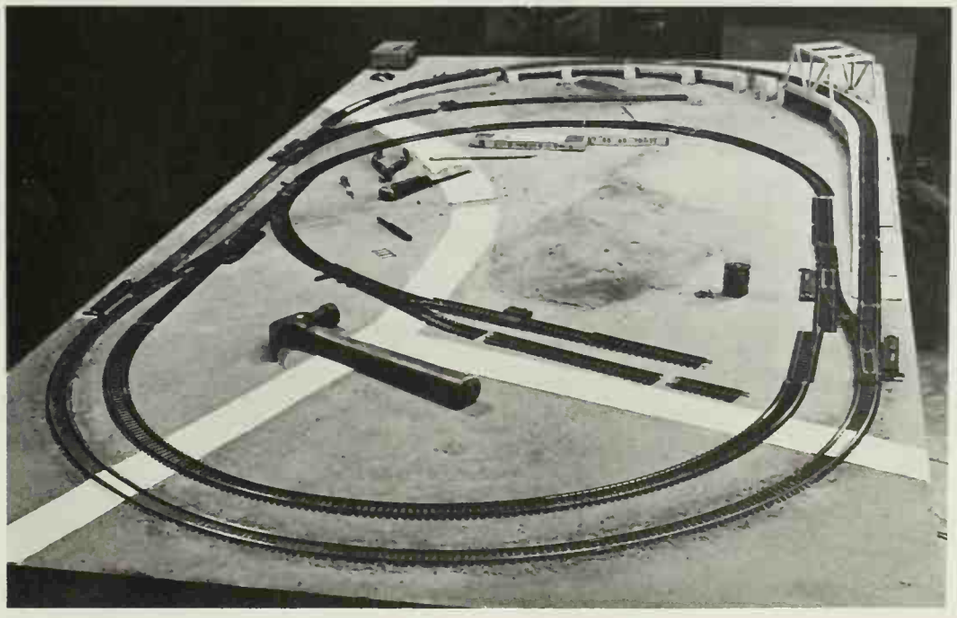


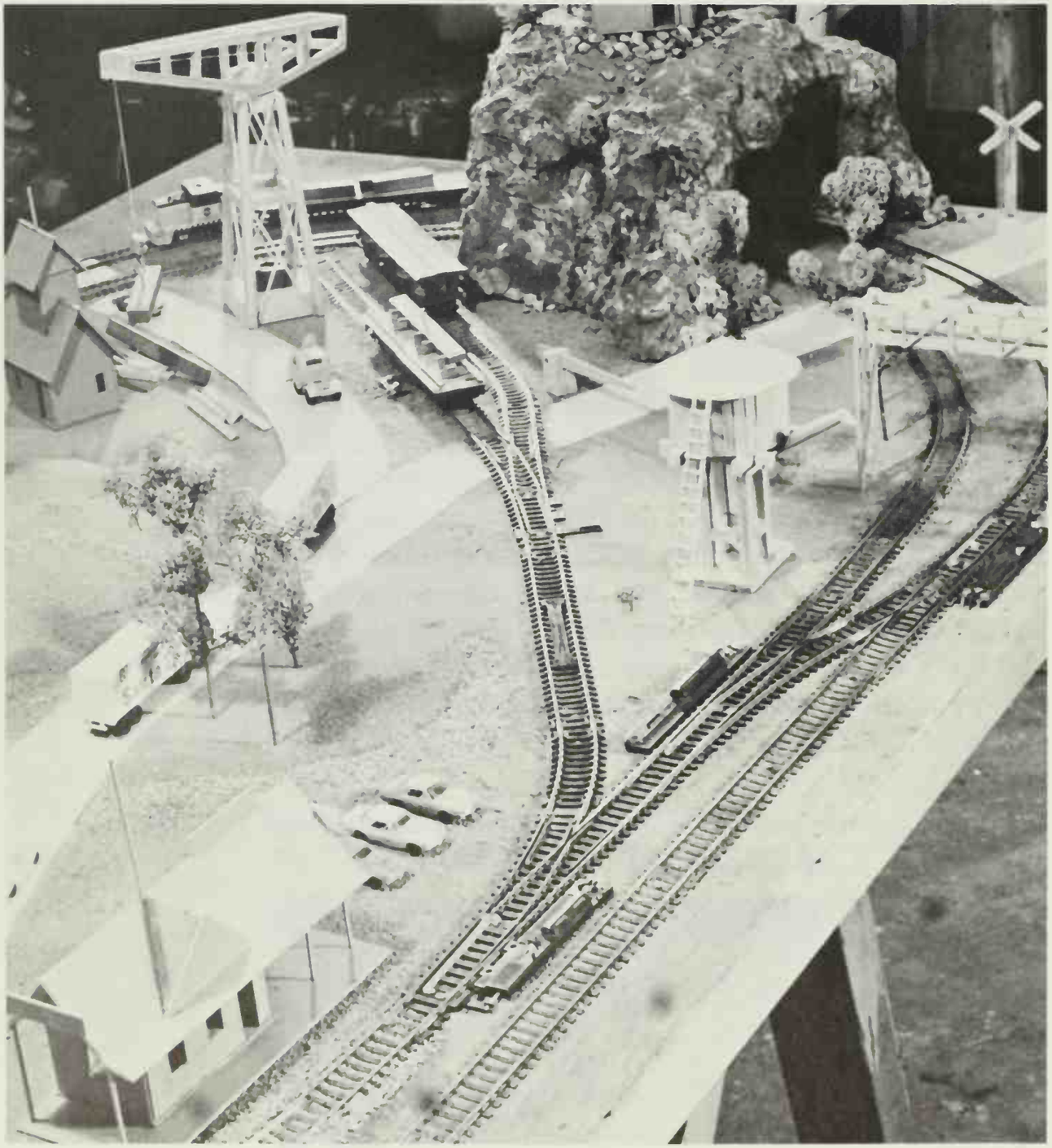
Experienced model railroaders with lots of tracks and many trains use more complicated types of block control. They divide their tracks up into different electrical sections or blocks. Each block can be controlled separately. For example, even on a single loop of track, if you had three blocks, you could run three trains at the same time —one in each block—and each one at a different speed. This kind of control isn't really needed on a small layout, however. And the wiring gets to be fairly complicated. Some of the books on advanced model railroading that you'll find in most hobby shops go into these matters in great detail.



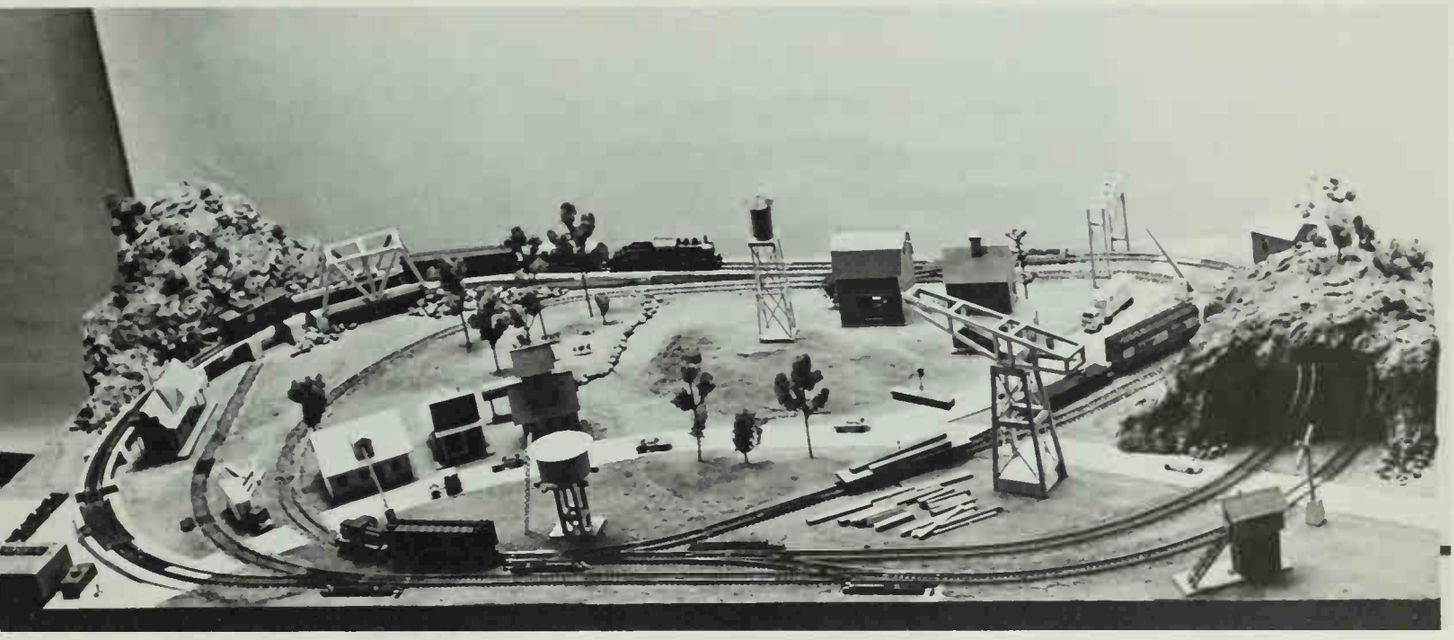
There was still a good deal of space left in the center of the inner oval. I could have built a little town with many buildings, or a coal mine, or a large factory, or all sorts of mountains. But I decided a freight yard would be more fun. I got two more switches, an uncoupler, and some more track sections and made the arrangement shown. And that, for the time being, was just about all the track I could squeeze onto my 3½- by 7-foot table. However, there were still other expansion possibilities, things to think about for the future.

This is how the train table looked while the new track was being installed. Everything movable had been removed except for the trestle and bridge and the small hill in the center which were permanently attached.





You can see here the arrangement of switches for the inner and outer loop and for the freight yard.



Here is an overall view of the modified NP & H. The steam locomotive is pulling a few cars on the outer oval, and a small diesel switcher is at work on the inner oval.

More Possibilities

More room. This is the first change that comes to mind when you think of expanding a model railroad. If you have the space in your room, it is not difficult to add another piece of plywood to what you already have. (If you have O-gauge trains that aren't permanently attached to plywood, all you have to do is add on more track sections.)

More up and downs. You may decide to raise part of your trackage to an upper level. This is a little difficult if there are many switches in your layout. The switches will prevent you from gradually building up the grade along a long uninterrupted stretch of tracks. This was the case

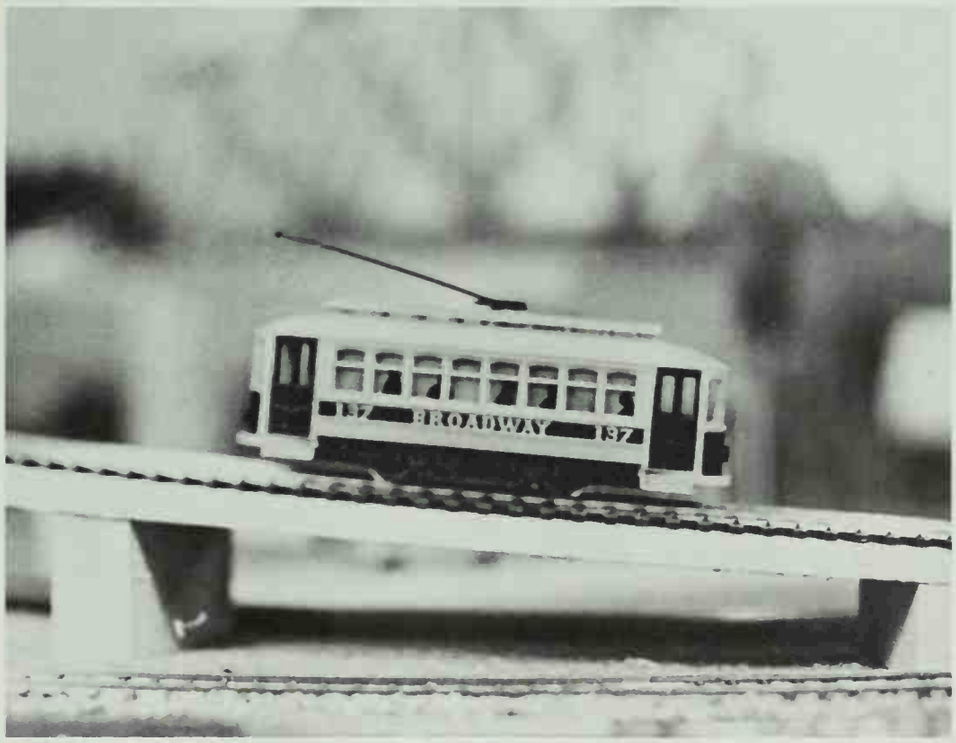
with the NP & H. If you can manage it, however, you will be able to build all kinds of bridges and tracks crossing over tracks in interesting ways.

More landscaping. Landscaping can get quite elaborate. If your first little hill or mountain was a success and you like working with plaster, you can make dramatic scenes that cover the entire tabletop. Ambitious landscaping gets to be rather cumbersome and massive with O-gauge trains, but it's fine with HO or N gauge.

Add a trolley line. This is a great way to use leftover space to add a lot more interest and action to your railroad. Most model trolley cars, or at least the small, less expensive ones, have only four wheels. Therefore they can go around very sharp curves and into odd corners. If you want to fit the line into a tight space, you will probably have to use the flexible track sections that can be bent to any curve you want, rather than the more rigid, snap-together tracks. (Page 50 describes how this track section is used.)

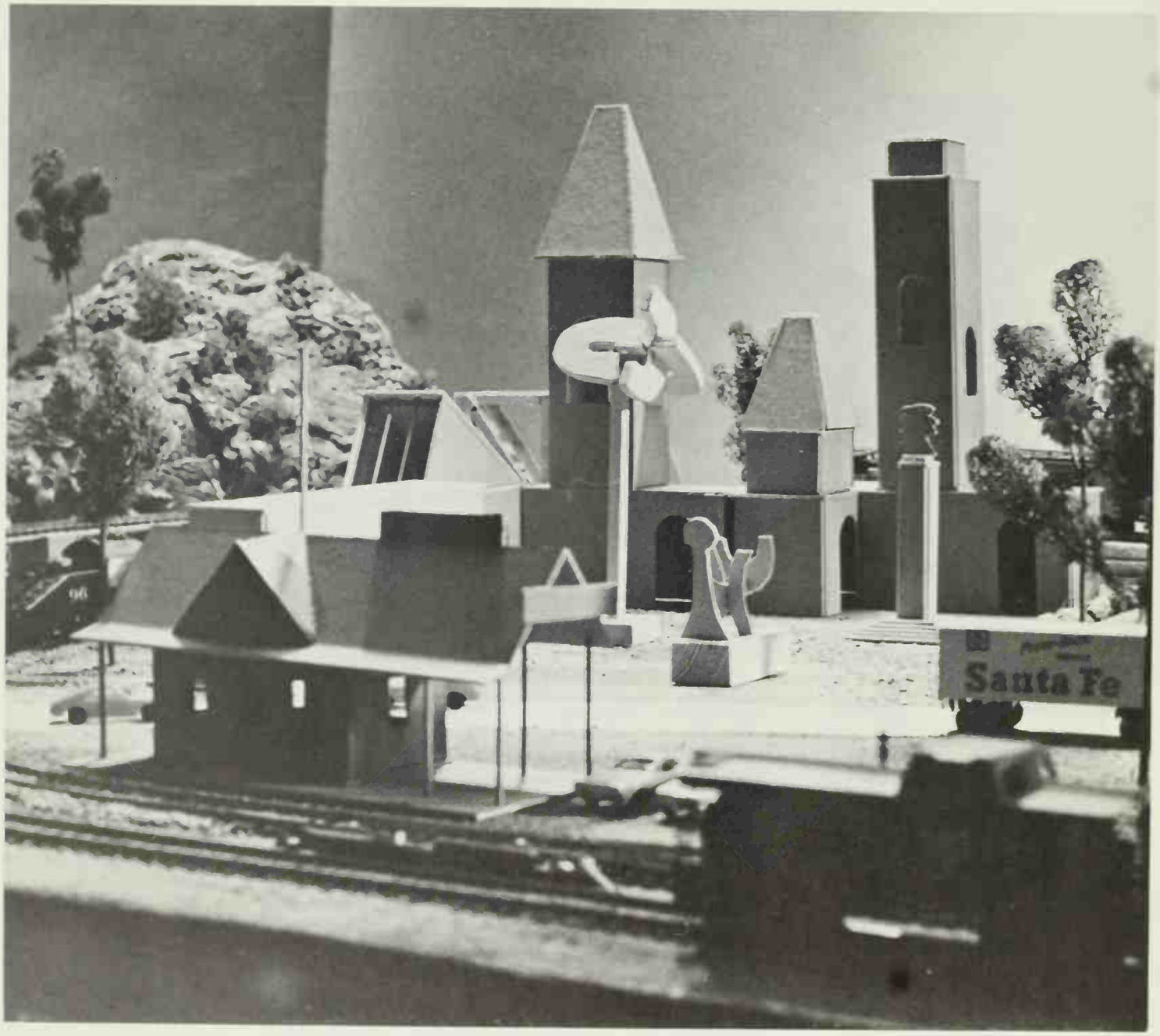
In HO gauge there are many different styles of trolley cars available—both modern and old-fashioned. The electrical hookup and controls as well as the switching are the same as for regular trains. However, once you start shopping around in model-train stores for very accurately made trolley cars (which are usually constructed of brass), you will be unpleasantly surprised by the prices. Fifty, sixty, or eighty dollars for an unpainted model is typical.

But fortunately, there are one or two popularly priced trolley cars with plastic bodies like the one illustrated. This is the one used on the North Piddleton and Happenstance Trolley Line, and it works fine.



Some model railroaders don't have any trains at all. They build only trolley lines with trolley cars. They have lots of track and usually a town or city landscape setting. This sort of thing can be fitted onto a relatively small tabletop.

Building trains. Some model railroaders get a lot of enjoyment from putting together locomotives and rolling stock from kits. The kits contain all the separate unpainted parts, which the builder must assemble. Some kits are fairly simple. Others are complicated and require lots of skill and patience. The results are often so realistic you can hardly tell, in a photograph, the difference between the original and the model. A large, top-quality locomotive, well painted, built from a kit, with a lot of extra details added, can sell for well over a hundred dollars!



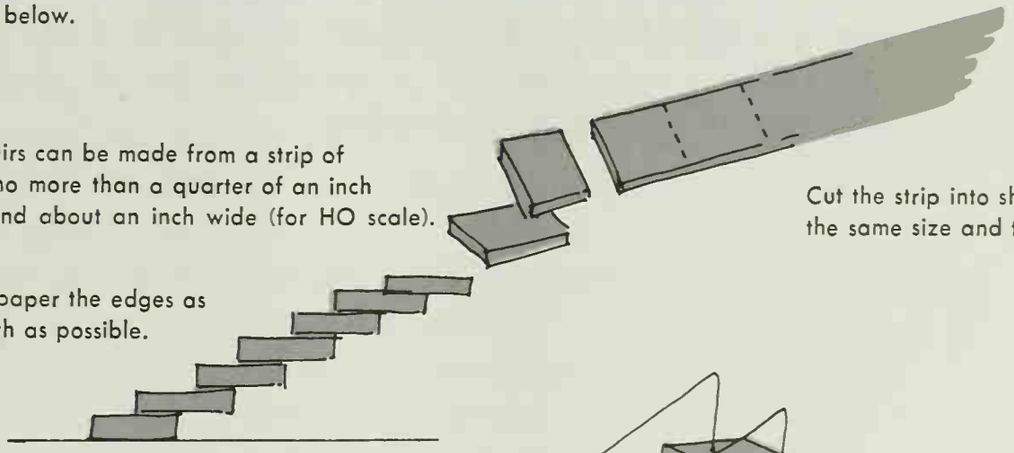
Here are the same buildings that were shown on page 67. When that photograph was taken, the buildings made up North Piddleton University. Now they have been moved elsewhere and rearranged. Some small cardboard and balso-wood sculpture has been placed in the center courtyard, and we now have the North Piddleton Museum of Fine Art!

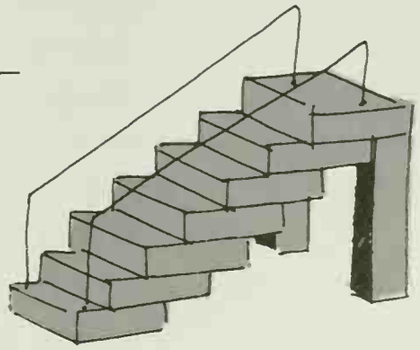
This rather oddly proportioned elevated station is supported on dowels. The interesting feature is the elegant-looking staircase, which can be mode as shown below.

The stairs can be made from a strip of wood no more than a quarter of an inch thick and about an inch wide (for HO scale).

Cut the strip into short pieces all the same size and then glue together.

Sandpaper the edges as smooth as possible.





Dowels or small wood blocks can be used for supports as needed.

If you want to be fancy, make railings out of stiff wire or thin sticks.

More buildings. Most model railroads can be greatly improved with more and better buildings. These can get as elaborate as you want. There are kits for making everything from a simple shed to a complex factory. Or you can design your own structures using cardboard or balsa wood as discussed in Chapter 8.

More information. When you become more experienced and your trains begin to expand beyond the limited size and complexity of the layouts shown in this book, the controls begin to get fairly complicated. The wiring and the landscaping and the switching arrangements require more advanced information. You'll have to go beyond the introductory material contained on these pages, and read some of the books and magazines that cover these subjects.

You should also be able to get at most hobby stores the free catalogs and layout booklets that some train manufacturers publish. These will tell you exactly how many pieces of what kind of trackage and what kind of switches and controls are needed for a particular layout. This is sometimes very helpful information.

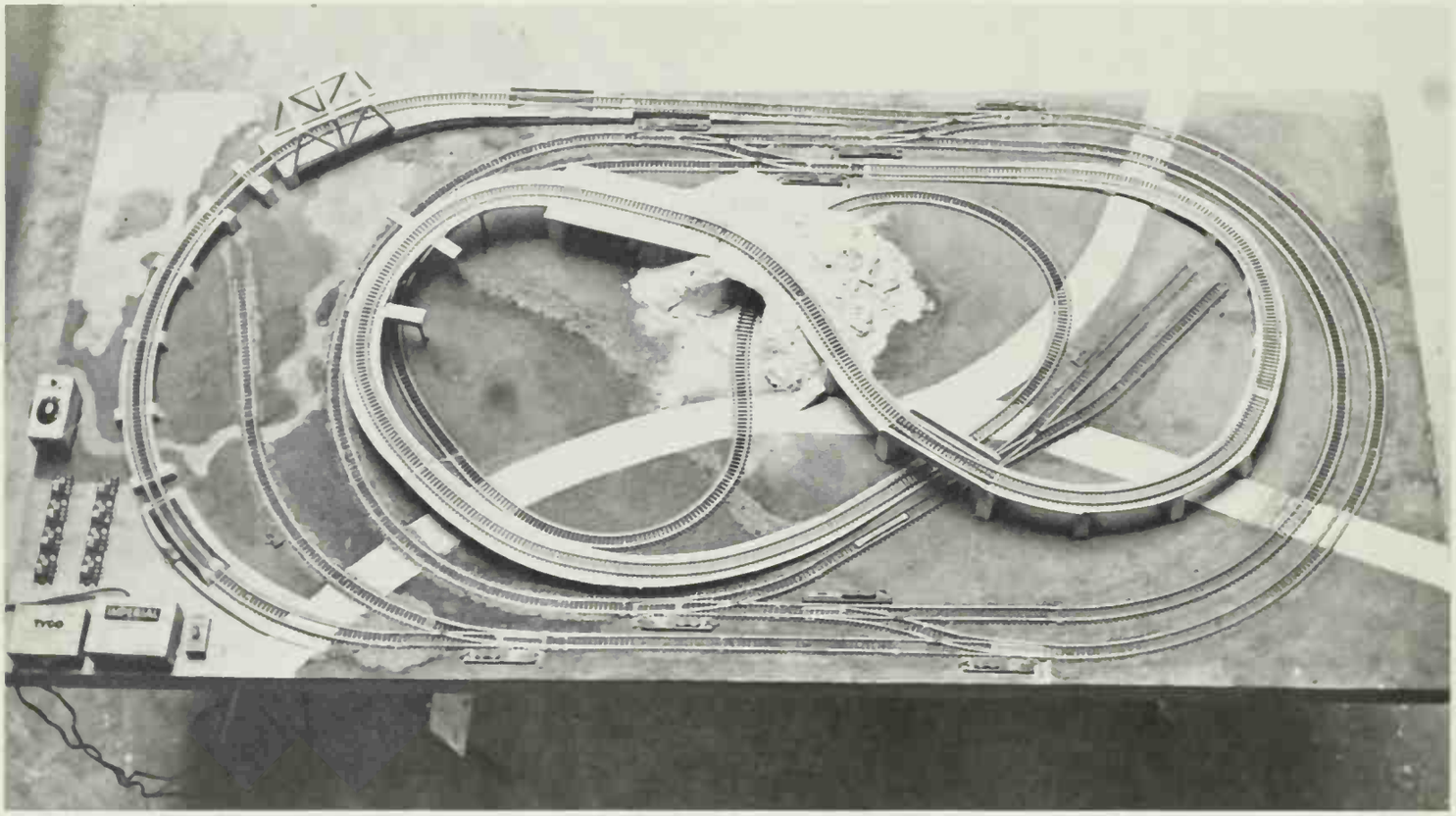
12. Breaking All the Rules

Most of the layouts, switching, and landscaping discussed in this book are designed to create a little railroad world that is as realistic as possible. Buildings, trees, grass, and so forth, are made to look like the real thing. The operation of the trains is as close as possible to actual railroading procedures. This is what most model railroaders strive for. Realism is the goal.

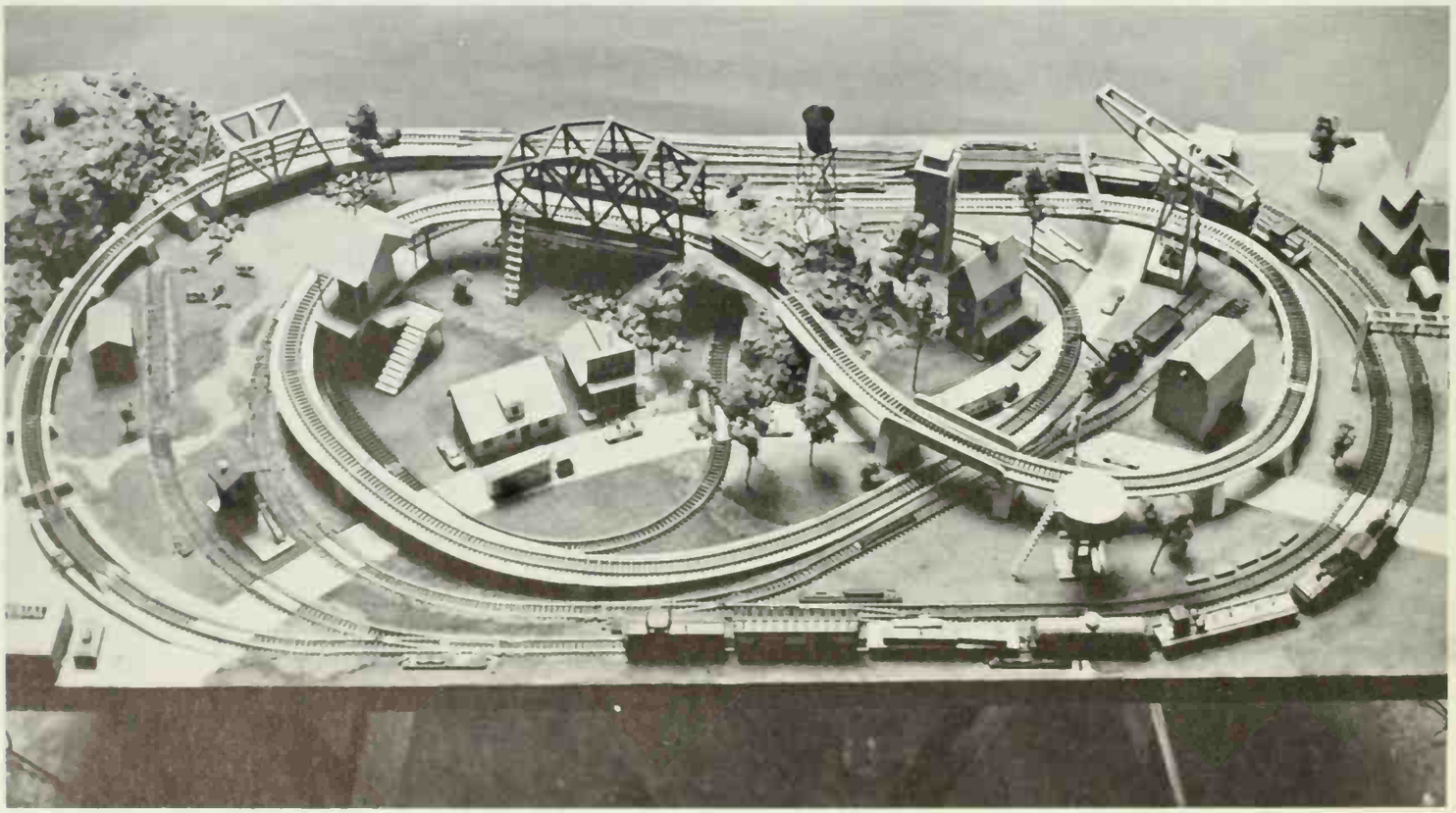
But suppose you don't think this way? Suppose you don't really care about realism? There is at least one person I know of (the president and general manager of the NP & H) who decided to try a completely unrealistic kind of operation—just for the fun of it, and to see how interesting a combination of track and train movement and setting could be devised.

The photographs on the next few pages show how the NP & H was changed for this purpose.

There were limitations to what could be done, of course. The trains had to actually get about. The track couldn't go up too steep a grade. Switches had to operate properly. Curves couldn't be too sharp. The two outer loops were, in fact, not changed at all. The changes were made by adding still another inner-inner line of track.

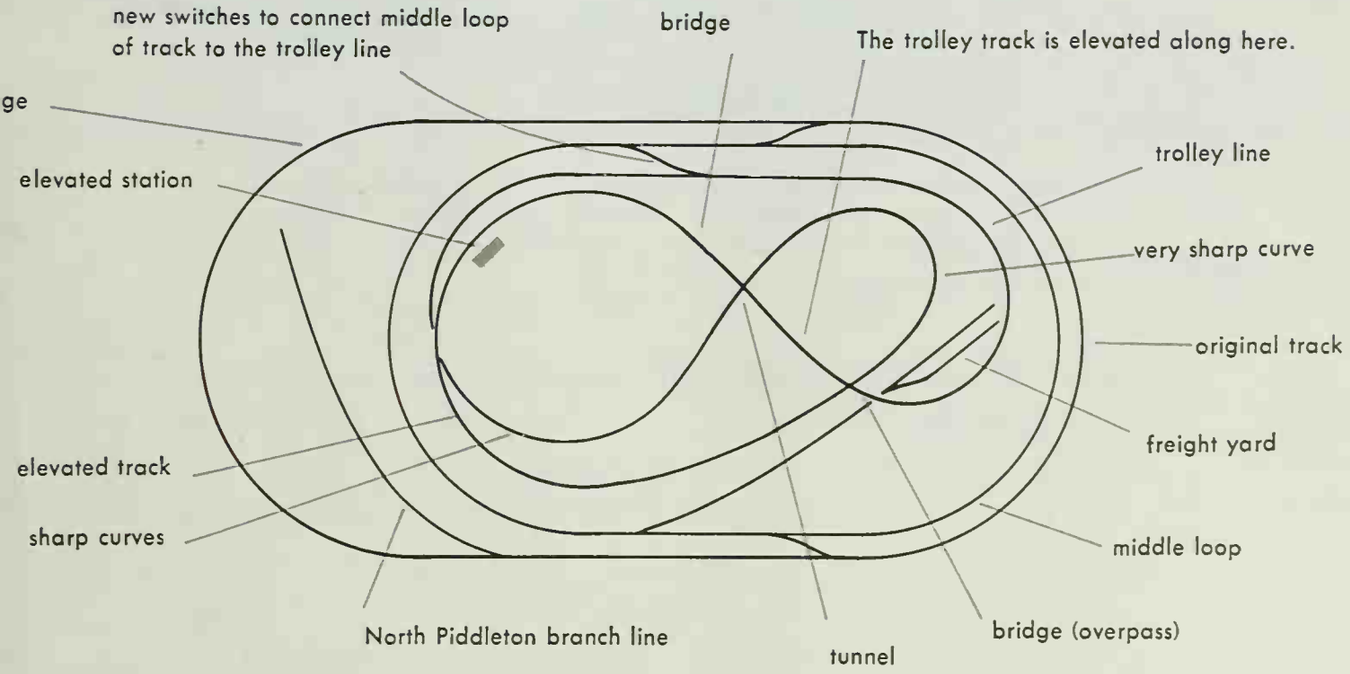


This is the bare track arrangement of the NP & H after the inner-inner trolley line was installed. A great deal of track has been squeezed into a small space. The photograph below shows how it looked after all the landscaping details were put in place.



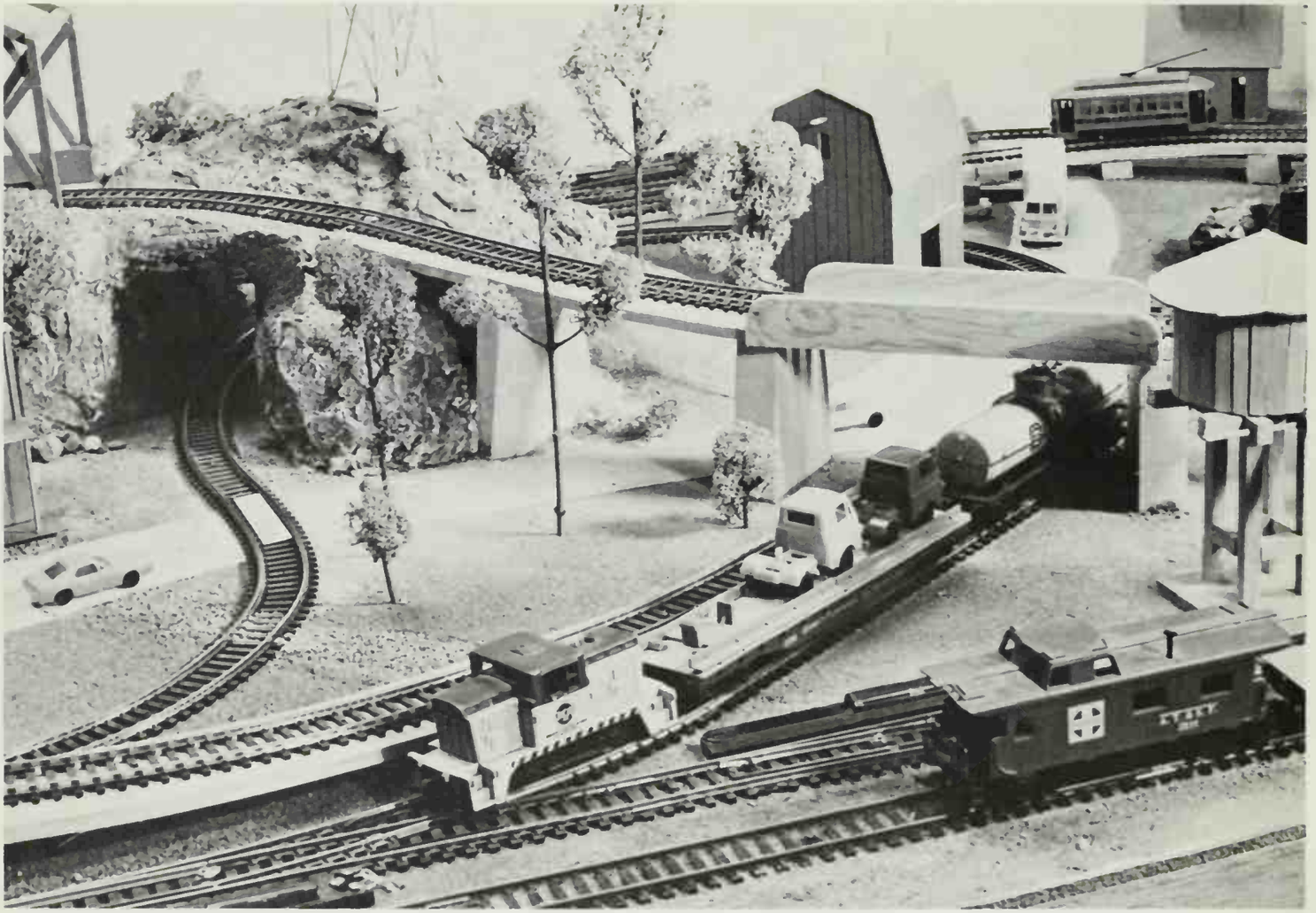
This track had very narrow curves and steeper-than-normal grades. An ordinary large freight or passenger train couldn't manage them. But a trolley could. So I decided this would be a trolley line. It was electrically separated from the other loops by means of plastic connectors and it had its own power pack. (See page 109 about how this is done.)

But when the track was finished and I was trying it out, I found, much to my surprise, that both the diesel switcher and the steam locomotive could travel over this line with no trouble. They had only four wheels, so there was no problem . . . as long as they didn't go too fast. I also discovered that they could pull certain of the freight cars. Other freight cars couldn't get around the tight curves because the corners of the cars bumped into one



This is the final track plan of the NP & H.

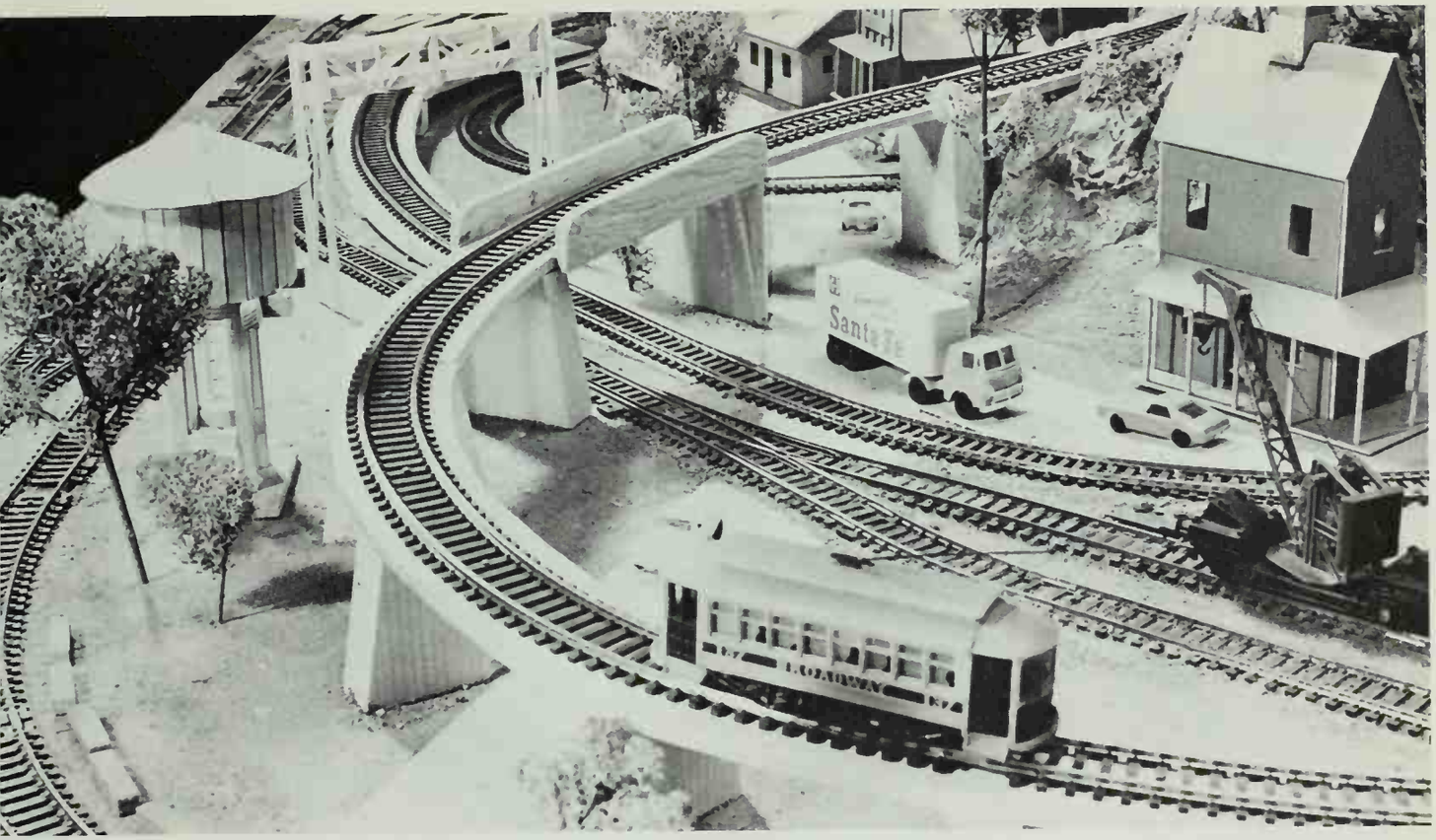
Because the trolley line has many sharp bends and unusual curves, ordinary, snap-together, sectional track couldn't be used. Instead long strips of flexible track were cut and joined together, as explained in Chapter 6 .



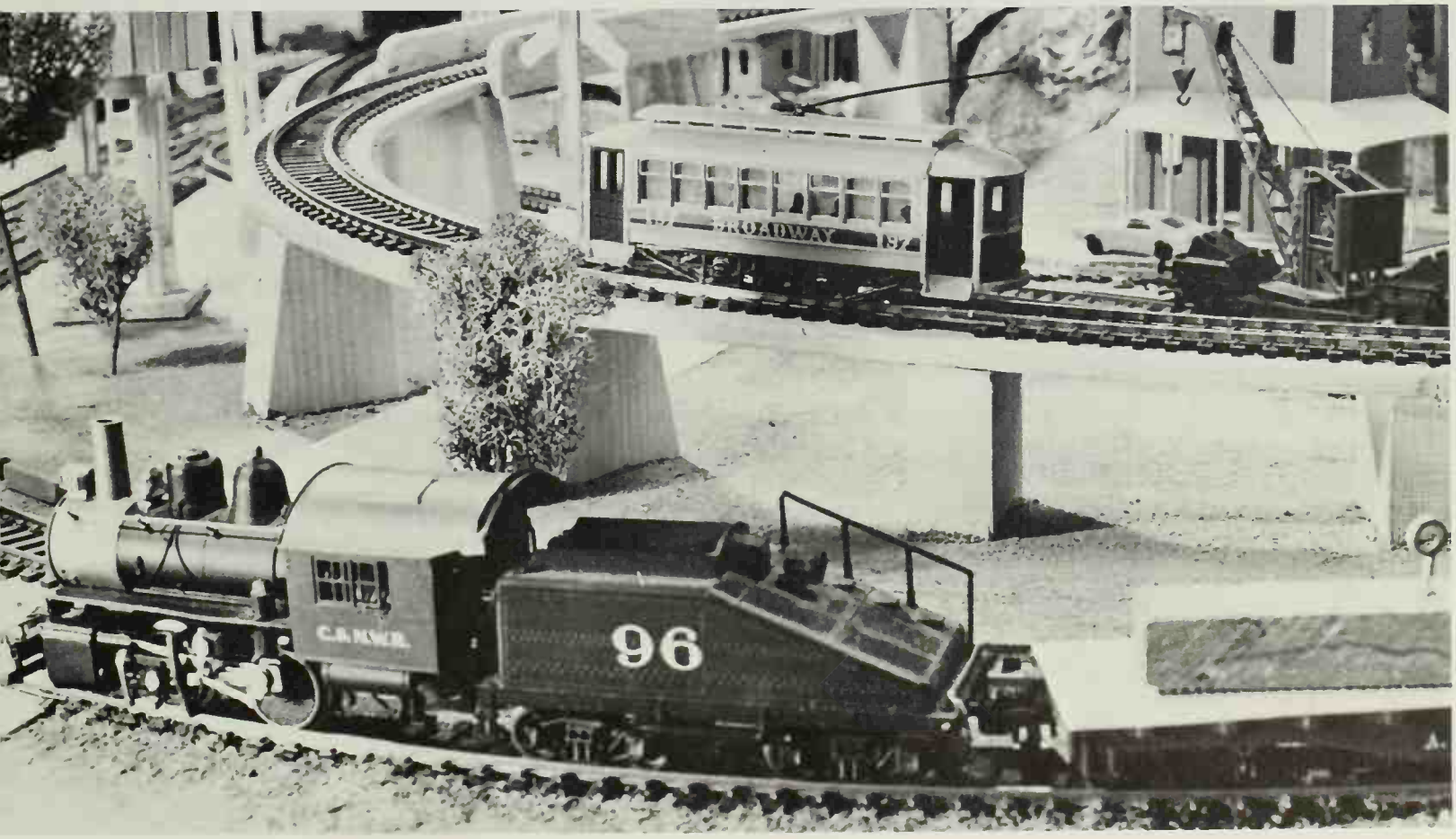
All three lines are in operation here. A load of freight cars with the caboose at the end has just passed on the outer loop. The small diesel switcher is doing something with some cars in the freight yard, and the trolley is buzzing about on its business on the innermost trolley loop.

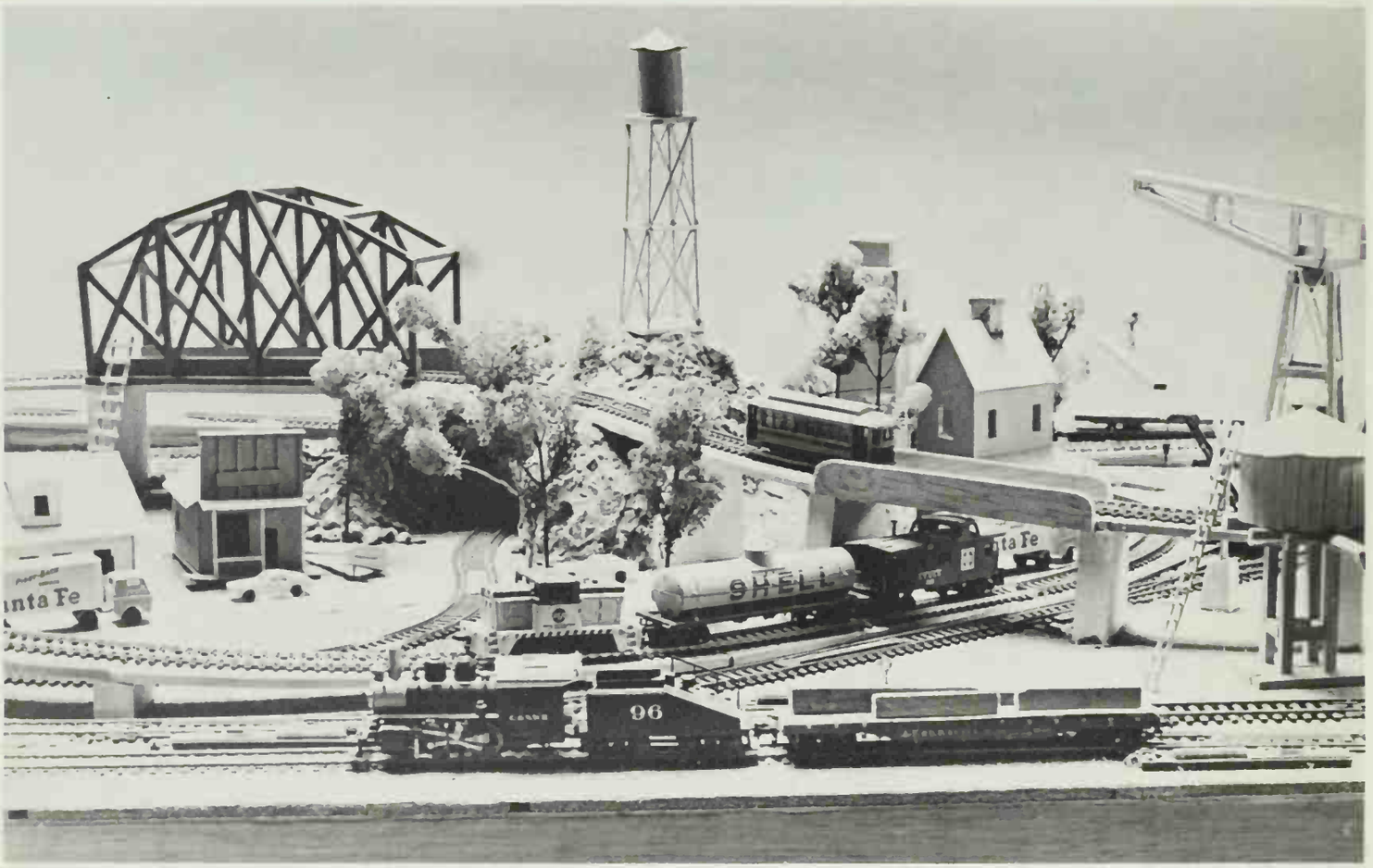
another, causing derailments. Because of the steep grades, however, the locomotives couldn't pull more than two or three cars without slipping or stalling.

The trolley was designed to get around on sharp curves, so it had no trouble at all. The trolley was also able to switch onto the main line and the inner loop. It could, in fact, go anywhere, and it turned out to be great fun sending it all over the place!



Two views of the NP & H in its (for the present) final form. There certainly doesn't seem to be room for any additional track—but changes aren't hard to make, and who knows what ideas will next occur?





The NP & H at work.

As the photographs show, most of the tracks for this new line were elevated above the original train tracks. This allowed for greater flexibility. Tracks could cross over other tracks, and get into places that couldn't be reached in any other way. The track plan was basically a figure eight with one part crossing over the other. Two switches served to connect it to the inner loop. The track was supported by a great variety of trestles, which were fun to experiment with. And there are also a few additional bridges.

The buildings and landscaping were modified to suit what was now a very busy and cluttered track arrangement. They were designed and placed for the sake of variety—for the sake of interesting groupings and space arrangements, rather than for practical or realistic use.

Some of the commuters who travel on the NP & H may think this a very odd little railroad world, and may not like it a bit. But I think it is just fine!

About Harvey Weiss

Harvey Weiss has written and illustrated many books for children, among them *The Gadget Book, Games and Puzzles You Can Make Yourself, How to Make Your Own Books, Model Airplanes and How to Build Them, Model Cars and Trucks and How to Build Them, Motors and Engines and How They Work,* and *Ship Models and How to Build Them.* A distinguished sculptor, whose work has received many awards and has been exhibited in galleries and museums across the country, Mr. Weiss brings to his books a sure sense of what appeals to and can be accomplished by young people, and a sculptor's eye for simple, uncluttered forms.

A dedicated tinkerer and gadgeteer, he has exercised his considerable and varied skills on such projects as the elegant model-railroad world described in this book; a wholly impractical but very handsome, very complicated steam-powered model airplane; and a large model tugboat, also steam-powered. He is at present planning an electrically powered model cable car that will run from the corner of his house to a distant tree and—he hopes—back again, an undertaking he describes as thoroughly useless but fascinating. Mr. Weiss is an assistant professor of sculpture at Adelphi University and lives in Greens Farms, Connecticut.

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